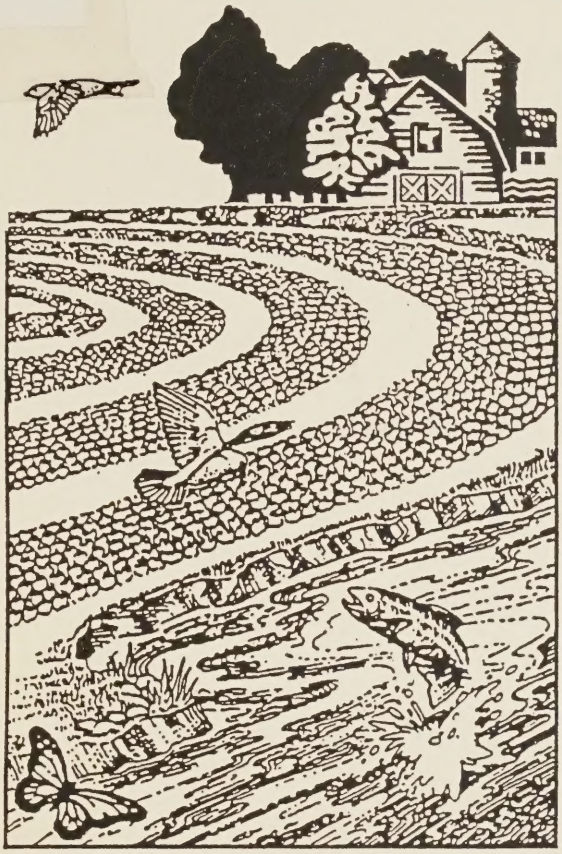

S·A·R·E/A·C·E

North Central Region 1993 SARE\ACE Report to Congress

Sustainable Agriculture Research and Education
and
Agriculture in Concert with the Environment

June 29, 1993

North Central Region Program Coordinator:

Steve Waller
Office of the Dean
207 Agriculture Hall
University of Nebraska-Lincoln
Lincoln, NE 68583-0701

Regional Communications Specialist:

Lisa Jasa
207 Agriculture Hall
University of Nebraska-Lincoln
Lincoln, NE 68583-0701

SARE Associate Director:

J. Patrick Madden
University of California
1207 Campbell St.
Glendale, CA 91207

ACE Program Director:

Harry W. Wells
Environmental Protection Specialist
Pollution Prevention Office
USEPA MC 7409
401 M St. SW
Washington, D.C. 20460

The North Central Region includes:

Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

SARE/ACE 1993 North Central Region Report to Congress

Executive Summary

The North Central Region SARE/ACE program, under the direction of the regional Administrative Council, continues its strong tradition of innovative leadership in providing opportunities for meaningful involvement of farmers and ranchers. The Council has established the Nation's first Producer **Grants Program**; the other three regions are establishing somewhat similar programs. The North Central Administrative Council was also the first among the regional programs to develop a **Strategic Plan** to guide the program in finding new and better ways to promote the goals of sustainable agriculture, as set forth in the Food, Agriculture, Conservation and Trade Act of 1990.

The Administrative Council and its advisory Technical Committee are comprised of a diverse mix of 35 of the region's leaders in sustainable agriculture. Chairs have been producers or representatives of private agricultural foundations, the Soil Conservation Service, extension, or research. Such diversity has led to dynamic discussions about the direction of sustainable agriculture in the region and has helped the Administrative Council identify and pursue issues relevant to the region. Many of the projects funded during the early years of the program, starting in 1988 as the LISA program, have now reached the results stage. Innovative methods are being developed to disseminate these results to farmers in ways that will encourage further adaptation to site-specific conditions, and enable farmers to adopt sustainable agriculture methods and systems in ways that will protect the environment, the financial security of the farm families, and the quality of life in rural communities.

Part I of this report is an overview of the North Central Region's program and its major accomplishments. Part II is a compendium of all North Central SARE projects funded since the program began in 1988. Part III is a similar compendium of ACE projects. Part IV describes the grants given to farmers through the new Producer-Initiated Grants Program funded by the SARE/ACE program in 1992.

Selected Highlights of North Central Region Projects

Reducing Chemical Use

A study of reduced chemical use in a commercial apple orchard found that chickens could be used to reduce vegetation as efficiently as any herbicide. In addition the chickens reduced the population of harmful insects, while providing a secondary income for the producer. (See Project number LNC89-22 in Part II of this report.)

An economic analysis of 30 Wisconsin dairy farms showed that the no-chemical producers had a net return on their crops that was 56 percent more per acre than their conventional counterparts. (LNC90-27)

Researchers and farmers are working together to learn how farm landscapes can be used to support natural predators and more effectively control insect pests and weeds. (LNC91-39)

After CRP

One project is drawing community members together to find the best overall solution for highly erodible fields when the national Conservation Reserve Program (CRP) acres are returned to production. Bankers, local business people, producers and local government representatives are working together to do on-farm research and hold local programs to educate producers on the best options for grazing highly erodible lands. (LNC92-51)

Educating Prospective Farmers

College and high school students will be learning more about sustainable agricultural practices and how to incorporate them into more traditional agricultural operations through several projects in the North Central Region which are developing curriculums and classroom models. (ANC91-7) (ANC91-8)

A study of an innovative crop rotation system implementing ridge tillage and strip planting found that wheat, corn and soybean yields were all affected by the position and direction of the strip. Corn yields in the outside rows bordering wheat on the east side and soybeans on the west side were 33 and 54 percent higher, respectively, than the average yield of the center two rows. (LNC92-34)

More results from these and other projects are summarized in PART II and PART III of this report -- SARE and ACE, respectively.

Farmer Involvement

Producer Grant Program: Implementing Sustainable Agricultural Practices

The region developed a producer grant program to help farmers and ranchers identify problems and find solutions to problems they encountered in implementing sustainable agriculture. Through on-farm, real-application research, producers are examining rotational grazing, sugarbeet production, innovative cropping practices, and biological weed control. Several are modifying equipment to better meet the needs of a more sustainable system. Producers are sharing their progress with other producers through field days, workshops and publications, multiplying the value of their on-farm research. The problems identified by producers also may help the Administrative Council determine areas that should be emphasized in future calls for research and education project proposals.

Regional Program Activities

Mission of the Regional SARE/ACE Program

A strategic plan was developed and published to define the mission and goals of the Regional Program to expand the adoption of sustainable agriculture. It calls for more directed calls for

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PART I. OVERVIEW OF NORTH CENTRAL *SARE* AND *ACE* PROGRAMS

Highlights of Results From 1992 Annual Reports of Projects

- Commercial **tomato** producers can significantly reduced the cost of purchased **pesticides** while maintaining quality production by interseeding **cover crops** with tomatoes to provide nitrogen and control weeds. (Project number LNC91-33, Low-Input Sustainable Agriculture as Applied to Vegetable Production Systems)

- More than 300 people attended the National Conference on **Participatory Research and Education** for Agricultural Sustainability held July 30-Aug. 1 in Champaign, IL. Participants and attendants learned from farmers and researchers about the role of on-farm research and education in developing sustainable agriculture systems. (Project number LNC91-40, Participatory Research and Education Network for Sustainable Agriculture in Illinois)

- In a study of commercial **peach** production in Michigan, nitrate levels in the water below the root zone were reduced by applying fertilizer through drip irrigation or by applying horse manure without a significant different in leaf nitrogen. (Project number ANC91-9, Reduced Chemical Input Production of Peach)

- In a study comparing **dairy** cow performance in **rotational grazing** and conventional stored feeding systems, net returns were found to be consistently greater for rotational grazing. (Project number LNC90-27, Rotational Grazing for Wisconsin and Minnesota Dairy Farmers -- An Evaluation of Animal and Forage Performance and Whole Farm Socio-Economic Analysis)

- More than 200 Wisconsin **high school teachers** were trained in sustainable agriculture concepts through workshops and a summer course. Agricultural students benefitted through new information as well as through participation in a Discovery Grant program to facilitate sustainable agriculture projects at the student level. (Project number ANC91-8, Sustainable Agriculture Training and Support for High School Agriculture Instructors)

- A study of an innovative **crop rotation system** implementing ridge tillage, three-crop wheat-corn-soybean rotation, narrow, alternate strips and legume interseeding, found that wheat, corn and soybean yields were all affected by the position of the strip. Corn grain yields in the outside rows bordering wheat on the east side and soybeans on the west side were 33 and 44 percent higher, respectively, than the average yield of the center two rows. (Project number LNC91-34, Strip Cropping Systems to Reduce Energy Inputs and Optimize Profitability)

- A Michigan project is finding that a balanced system using **natural biological predators** can replace chemical pesticide applications in commercial **apple** production. (Project number LNC89-24, Development and Demonstration of Methods Toward Sustainable Apple Production)

Mission of the Regional SARE/ACE Program

The Administrative Council (AC) met in February, April, June and November of 1992, with its Executive Council meeting by teleconference with regional staff more often. The primary activities of the AC include developing and directing the execution of the Region's Strategic Plan, presented as the frontpiece of this report. This document:

- articulates the mission and goals of the Regional program;
- includes plans to ensure quality control in all aspects of the program, and to review annually the program's priorities for project funding; and
- sets forth several innovative ideas for new initiatives to better attain the goals of sustainable agriculture.

Other essential roles of the AC include publishing calls for preproposals and proposals based on agreed priorities, selecting projects to be funded, and disseminating the results.

Quality Control Measures Instituted

The Administrative Council initiated measures to enhance the effectiveness of the processes used in the Regional SARE/ACE program by:

- developing guidelines for project assessment, with increased emphasis on external peer review.
- addressing the apparent overlap in the ACE and LISA grant categories and developing an evaluation criterion recognizing the different objectives of the two programs.
- continuing an external review of the program with authors of non-funded proposals.
- conducting site reviews of projects. In conjunction with its meetings, the whole Council and invited guests conducted one site visit and heard two project reviews at its June and November meetings. (Attachment B lists the projects that received site reviews in 1992 and plans for 1993.)

Regional Staff and Organizational Development

Based on the first five years experience, the Administrative Council has initiated several procedures to improve the staff and organizational support for the program:

- Initiated a review of the regional support staff.

- Formalized a nomination process for membership on the Administrative Council, and developed a process for filling vacancies on both the Administrative Council and Technical Committee.

- Developed a process for the selection and approval of a Regional Coordinator.

- Created a position of Past Chair on the Administrative Council to facilitate a smooth transition from year to year of the project.

- Created an Executive Committee and authorized it to act on the Council's behalf. It includes the current and past chair of the AC, the chair of the Technical Committee and two other members of the AC.

- Supported a long-term commitment to the host institution, the University of Nebraska.

- Required increased dissemination of information about regional projects through the federal reporting structure, Current Research Information System (CRIS), and filed a regional progress report on all projects with the system. Project subcontracts now require that all projects, on their completion, prepare a CRIS report.

- Hired a part-time, temporary grants coordinator for budgets and contracts.

- Hired a communications specialist to implement its communication goals and develop a news service. The activities of the Communications Specialist have included the following:

  -- Developed, tested and revised the application and budget forms for the producer grant program.

  -- Prepared news releases and application information on the producer grant program and released them to a variety of popular publications and the major sustainable agriculture groups in the region; including followup to insure more widespread use.

  -- Initiated system to collect and archive slides of LISA/SARE/ACE projects in the North Central Region; 60 slides are on file with many more expected this year.

  -- Wrote and/or assisted with preparation of annual reports and requests for information on specific projects and the regional program.

  -- Provided all landgrant Universities in the Region with news releases and abstracts of 1992 projects funded in the state so they could release as is or expand for their own releases.

  -- Compiled list of individuals who would speak about the regional program for a Speakers Bureau.

-- Assisted Warren Sahs, former regional coordinator, with preparation of handout and display for International IFOAM Conference.

-- Hosted the Sustainable Agriculture Network Committee meeting in Lincoln in September.

Selection of SARE and ACE Projects for Funding

Again in 1992, the North Central Region used preproposals as a means of encouraging the synthesis of innovative ideas which can be developed more fully at the proposal stage. The types of preproposals submitted were:

Experimental
Exploratory
Integrated Systems
Educational
On-farm Demonstrations
Impact Assessment

Subject areas of preproposals were:

Reduced use of pesticides
Pollution prevention
Erosion control/conservation tillage/crop residue management
Multiple uses of forage/grassland systems: Cover crops, rotational grazing, intercropping, forestry influence
Innovative educational methods for sustainable farming:
    Farmer-to-farmer networking
    On-farm research and demonstration sites
    Classes for teachers at high schools, vocational schools, and colleges
Agronomic and whole-farm analysis of sustainable systems
Social and cultural factors affecting sustainable farming systems
Reduced purchased inputs in commercial horticultural production
Low-input livestock production and whole-farm systems
Biological controls in agricultural and horticultural production
Management system comparisons

All the proposals were reviewed by the Technical Committee and by external reviewers who augmented the professional expertise of the Technical Committee to ensure top quality evaluation of all proposals. The reviewers' comments for each proposal, both funded and nonfunded, were compiled and provided to applicants so that they could learn about why a proposal was or was not funded and consider submitting a revised application next year.

A total of 118 LISA and 37 ACE preproposals were received in Fiscal Year 1992. Of those, 26 LISA and 15 ACE full proposals were determined by the Technical Committee to be technically acceptable and were forwarded to the Administrative Council. The Council recommended funding 14 LISA and 5 ACE proposals (See Tables 1 and 2 in the Appendix to PART I.) These funding recommendations were sent in the Regional Plan of Work to the Secretary of Agriculture, who officially approved their funding. (The projects selected for funding in FY 1992 are Described in Part III of this report.)

Types of Projects Currently Active:

Of 41 currently active or recently completed SARE projects funded since 1988 for which project profile data are available:

- 16 projects include experimental components;
- 21 are for "educating the educators" (such as Extension);
- 6 contain exploratory components;
- 12 include whole-farm analysis;
- 24 feature whole-farm or ranch demonstration sites;
- 22 will provide accounting budget data on costs and returns for rotations and enterprises.
- 14 Extension staff are project coordinators; a total of 56 Extension staff are major participants, and another 58 are cooperators in SARE projects.

Farmers Are Meaningfully Involved

One of the strengths of the North Central Regions's SARE/ACE program strategy has been its direct and extensive involvement of farmers and ranchers in every phase of program activity. Farmers have always played major roles in administering and operating the Regional program, in cooperation with scientists, educators, and agency personnel. For example,

- 4 farmers serve on the North Central Region's Administrative Council, which sets the regional program's priorities and determines the level of funding to be granted to approved projects;
- another 5 farmers serve on the Technical Committee, which recommends projects worthy of funding;
- 57 farmers have helped generate ideas for project proposals;

- 129 farmers are "major participants" in funded projects;

- 65 farmers have made presentations at workshops;

- land is provided for studies of sustainable farming practices and systems:

    -- 65 farmers provide land for replicated studies;
    -- 59 provide land for unreplicated studies;
    -- 78 provide land for demonstration plots;

- 46 farmers help manage projects, and 60 help evaluate the projects.

Initiated a Producer Grants Program

This new initiative, entitled "Implementing Sustainable Agriculture Practices," is designed to enable more producers to take the lead in solving problems limiting their transition to a more sustainable agriculture. The Administrative Council received 109 applications and awarded 25 grants, as listed below. (Part 4 of this report contains a more complete description of these Producer Grants.)

Brutlag, Alan; Wendell, MN: Use of a modified ridge-till system for sugar beet production using a spring cover crop to protect seedlings and reduce erosion; replicated plots with reduced nitrogen use to improve quality and profits; demonstrating sustainable weed control.

Ferrell, Pete; Beaumont, KS: Establish and evaluate a rotational grazing system using a professional herder and trained dogs to confine a multi-species herd to 75-100 acres at a time, rather than routinely moving fences and a water supply.

Herren, Michael and Debi; Kampsville, IL: Establish and evaluate rotational grazing pastures on highly erodible land with a warm season prairie grass and a cool season grass to produce high quality sustainable forage.

Holle, Oren; Bremen, KS: Evaluation of agronomic and economic benefits of three to four annual alfalfa varieties to sweetclover for forage and soil-building purposes in a corn, soybean, milo, soybean, wheat/legume rotation.

Hueneke, Phil and Barbara; Bellevue, IA: Soil and tissue testing to evaluate which green manure cover crop provides the best plow-down nitrogen using red clover, alfalfa and interseed red clover and no-till rye into alfalfa; also yield checks.

Jeanquart, Ed, Forestville, WI, and Kevin Kiehnau, Egg Harbor, WI: Case studies of two dairy

farms to evaluate labor and time management needed for sustainable farming systems, and to plan for and test possible modifications.
Jones, Lawson; Webster, ND: Develop equipment and cropping system to grow sunflowers in small grain residue; residue will trap winter precipitation and reduce evaporation in spring and early summer, promoting seedling growth.

King, Kenneth O. and Judy; Hutchinson, KS: Evaluation of four-six grass legume species in a rotational grazing operation with dairy and stocker cattle, including stand establishment, cattle palatability and grazing potential.

Kirker, Kevin and Lisa, Merrill, WI: Trial and evaluation of a conversion from raising dairy replacement heifers in a confinement system with purchased seed to a system incorporating rotational grazing.

Kleinschmit, William and Elizabeth, Hartington, NE: Conversion of a windrower to a compost turner, allowing fertilization of more acres with existing manure and fewer purchased inputs.

Kunard, Tim, Edgerton, KS: Testing of two legume establishment methods, broadcast and no-till drill, for 180-acre rotational grazing system; Also, construction of a heated sprayer to apply melted beef tallow to large round bales for weather protection.

McNeal, Charles, Paradise, KS: Evaluation of an intensive grazing system in a field of Soil Bank grass and testing of several legumes interseeded in wheat for grazing after wheat and before sorghum.

Michaelson, David, River GLO Farms, Dawson, MN: Evaluation of eight combinations and eight replications of on-farm and off-farm inputs for weed control and fertility to determine the most profitable in solid seeded and 30" row soybeans.

Parks, Darrell and Donna, Manhattan, KS: Testing and improvement of nutrient use from swine manure based on soil and manure tests; also, testing of application methods including overground spreading, knife application and sweep injection.

Polluk, Susan and William Andres, Maiden Rock, WI: Testing and evaluation of forage, soils, optimal fertility and correct forage mixes for rotational grazing pastures for a dairy herd; pastures will be evaluated and improved for more balanced rations.

Quaintance, Lee, Edgerton, KS: Grazing evaluation with rye sown in the fall for fall and spring grazing of stocker cattle with rotational strip grazing in spring; separate fields will test rye for grain production.

Rohlfing, Robyn, Plymouth, NE: Test plots comparing effectiveness of biological weed control with 42 cited weeds in low (farm-style) and high (garden-style) intensive crop situations on demonstration plots.

Rose, James H., Bringhurst, IN: Planting tomatoes, sweet corn and green beans into a cover crop of matted vetch mulch to reduce chemical input; testing modifications for a seeder to operate under these conditions.

Rosmann, Ronald and Maria, Harlan, IA: Use and evaluation of ridge tillage with and without herbicides in corn following beans in five trials, randomized and replicated six times; evaluate equipment adjustments.

Schroeder, Lowell, Stanton, NE: Development, construction and testing of non-chemical fly control traps for cattle in both cow-calf and dairy herd situations, thus reducing production losses and costs.

Sowatzke, David and Rosalie, Spring Valley, WI: Testing forage varieties successfully used in New Zealand and Holland for intensive rotational grazing for ease of establishment and ability to provide high quality feed for sheep herd; comparison with existing plots.

Thiel, Kathy, Chesaning, MI: Testing and evaluation of organic beef operation with OCIA-approved supplements; growing feed economically without chemicals; evaluating appropriate ration mixes.

Turkey Ridge Orchard, Gays Mills, WI: Testing the use of new scouting techniques and chickens in an apple orchard to control the plum curculio, the most significant pest in a sustainable apple orchard.

Wallingford, Kenneth, Effingham, KS: Develop and evaluate crop rotation and transition plans that are equally or more profitable than current system, but with fewer purchased fertilizer and chemical inputs; also, to seed clovers on set-aside and small grain acres.

Christopher Werronen for the Lake Geauga CSA Project, Leroy Township, OH: Evaluation of rotary spader tillage tool in cooperative farming situation, including short-term and long-term effects on soil ecology on a variety of farms with different soil types.

National Initiatives

The Administrative Council is cooperating in the regional implementation of these national initiatives:

1. **Sustainable Agriculture Development-Demonstration Initiative**.

Fourteen proposals were received in the North Central Region, two of which received funding:

- Promotion of Participatory Education in Sustainable Agriculture through On-farm Demonstrations and a Regional Workshop. Project Coordinator: Clive Edwards, 1735

Neil Avenue, The Ohio State University, Columbus, OH 43210. Phone: (614) 292-8209. $46,588.

- Science and Education for Agricultural Sustainability: A Model Farming Systems Demonstration. Project Coordinator: Richard Warner, University of Illinois, Agricultural Experiment Station, 1301 W. Gregory Dr., Urbana, IL, 61801. Phone: (217) 244-4232. $28,412.

2. **Water Quality Program (Nitrogen Testing Initiative).**

The North Central Region was awarded $10,000 to administer the review and funding process for this initiative. Proposal review committees met in Kansas City in August 1992 to review proposals and recommend funding. Grant awards were prorated according to the number of proposals received from each region. The North Central Region received 36 percent of the funds available nationally. Twenty-five projects were funded nationally, nine of which were in the North Central Region. The funded projects were:

- A Real Time Soil Nitrate Sensor. Project Coordinator: Lawrence D. Gaultney, Purdue University.

- Assessment of Soil Nitrogen Tests in Animal-Based Farming Systems: Iowa. Project Coordinator: Randy J. Killorn, Iowa State University.

- Assessment of Soil Nitrogen Tests in Animal-Based Farming Systems: Minnesota. Project Coordinator: Gyles W. Randall, University of Minnesota.

- Petiole Sap Nitrate Test for Predicting Nitrogen Needs of Irrigated Potatoes. Project Coordinator: Carl J. Rosen, University of Minnesota.

- Calibration of Residual Soil Nitrate for Predicting Supplemental Nitrogen for Sorghum. Project Coordinator: Donald H. Sander, University of Nebraska.

- Calibrating the Presidedress Nitrogen Soil Test for Specific Cropping Conditions. Project Coordinator: Donald Eckert, Ohio State University.

- Improvement and Implementation of the Pre-Plant Nitrate-Nitrogen Soil Test. Project Coordinator: Ron H. Gelderman, South Dakota State University.

- Assessment of Soil Nitrogen Tests in Animal-Based Farming Systems: Wisconsin. Project Coordinator: Larry G. Bundy, University of Wisconsin.

- Barriers to the Adoption of Improved Nitrogen Tests and Crediting. Project Coordinator: Peter J. Nowak, University of Wisconsin.

3. **National Economic Implications of Sustainable Agriculture**.

Six projects were funded nationally under this initiative, two of which were in the North Central Region. The funded proposals are:

- An Economic Analysis of Sustainable Agriculture Adoption in the Midwest: Implication for Farm Firms and the Environment. Project Coordinator: Marvin T. Batte, Department of Agricultural Economics, The Ohio State University, 2120 Fyffe Road, Columbus, OH 43210. Phone: 614-292-6406, FAX: 614-292-0078. $128,000.

- Economic, Environmental, and Sociological Research in Systems of Sustainable Agriculture. Project Coordinators: Glenn Helmers and Kevin Hernhardt, Center for Sustainable Agricultural Systems, 221 Keim Hall, University of Nebraska, Lincoln, NE 68583-0949. Phone: 402-472-1788, FAX: 402-472-3460. $156,000.

4. **Sustainable Agriculture Quality of Life Task Force**.

John Ikerd, University of Missouri, has organized and directed a national initiative to develop concepts and educational materials on quality of life, and to conduct a series of training seminars for Technical Committee and Administrative Council members in the four regions. All four of the regional Administrative Councils have heard presentations from this Task Force, and the first of the regional workshops has been conducted -- for the Northeast Region in January 1993.

APPENDIX TO PART I

Table of Contents of Appendix to PART I

Table 1. NORTH CENTRAL REGION 1992 FUNDED PROJECTS
SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM

1992 SARE #		Project Title	Project Coordinator	Organization	CSRS Funding	Matching Funds	Duration
NCR/LWF#	LNC #						
-3102 18-92	LNC88-9	Agronomic and Whole-Farm Economic Analyses of Alternative Small Grain/Row Crop Production Systems for the Northern Plains *Continuation*	James D. Smolik	South Dakota State University	47,150	49,500	1 year
-3103 15-92	LNC92-42	Regional Workshop for Educators on the Use of Cover Crops in Sustainable Farming Systems	Nick Robertson	Illinois Sustainable Agriculture Society	10,000	4,300	1 year
-3104 77-92	LNC92-43	Regional Extension and Education Curricular Materials for Sustainable Agriculture: A Planning Conference	Jim King	University of Nebraska	34,081	17,000	1 year
-3105 55-92	LNC92-44	On-Farm Research and Demonstration of Ridge Tillage for Sustainable Agriculture	Derrick N. Exner	Practical Farmers of Iowa	75,867	169,395	2 years
-3106 59-92	LNC92-53	Rotational Grazing Systems for Wisconsin and Minnesota Dairy Farmers: An Evaluation of Animal and Forage Performance and Whole-Farm Socio-Economic Analysis (LNC90-27)	Denny Caneff	Wisconsin Rural Development Center	108,000	67,600	2 years
-3107 66-92	LNC92-45	Midwest Alternative Agriculture Education Network	Patrick Moore	Sustainable Farming Association	120,000	137,900	2 years
-3108 71-92	LNC88-10.1	Substituting Legumes for Fallow in U.S. Great Plains Wheat Production *Continuation*	John C. Gardner	North Dakota State University	113,000	113,150	2 years
-3109 75-92	LNC92-46	Contour Strip Intercropping and Rotations to Reduce Soil Erosion and Energy Costs in Production Systems	Chuck Francis	University of Nebraska	90,000	107,620	1 year
-3110 85-92	LNC92-47	Innovative Approaches to Practical Education in Sustainable Agriculture	Clive Edwards	Ohio State University Research Center	112,390	148,579	2 years
-3111 20-92	LNC92-48	Evaluating Relative Impacts of Conventional and Sustainable Farming Systems on Rural Communities	John Ikerd	University of Missouri-Columbia	99,244	88,426	2 years

-3112 21-92	LNC92-49	On-Farm Demonstration and Evaluation of Sustainable Farming Systems	John Ikerd	University of Missouri-Columbia	65,250	50,000	2 years
-3113 41-92	LNC92-50	Social and Cultural Factors Affecting Sustainable Farming Systems and the Barriers to Adoption	Sonya Salamon	University of Illinois	72,018	58,037	2 years
-3114 111-92	LNC92-51	Training for Forage Production and Intensive Grazing on Highly Erodible Land	Jim Hoffman	Southern Iowa Forage and Livestock Committee (SIFLC)	12,445	14,200	2+ years
-3115 119-92	LNC92-52	The Adoption of LISA Techniques of Pest Management by North Central Fruit Growers	Craig K. Harris	Michigan State University	42,410	48,370	2 years
				TOTAL LISA	1,001,855.00	1,074,077.00	

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Table 2. NORTH CENTRAL REGION 1992 FUNDED PROJECTS
AGRICULTURE IN CONCERT WITH THE ENVIRONMENT PROGRAM

1992 ACE #		Project Title	Project Coordinator	Organization	CSRS Funding	Matching Funds	Duration
NCR/LWF #	ACE #						
-3015 153-92	ANC 92-10	Whole-Farm Economic Analysis of Medium-Sized, Single-Family Dairy Farms that Differ in Their Use of Purchased Chemical Inputs *Continuation*	Marv Kamp	WI Rural Development Center Ctr for Integrated Org'n University of Wisconsin	68,230	36,400	1 year
-3012 116-92	ANC 92-11	Impacts of Agricultural Management Systems on Economic, Environmental, and Wildlife Values of Altered and Unaltered Wetland Areas	Diane H. Rickerl	South Dakota State University	104,000	68,000	2 years
-3013 136-92	ANC 92-12	Impact of Tree Windbreaks on Distribution of Insect Pests and Their Natural Enemies in Sustainable Agricultural Systems	Robert Wright	University of Nebraska	99,500	168,653	2 years
-3014 150-92	ANC 92-13	Biological Control of Weeds in Corn and Soybeans with Dwart-Grassica Smother Plants	Donald L. Wyse	University of Minnesota	67,000	80,600	2 years
-3011 102-92	ANC 92-14	Development of Methods Toward Sustainable Apple and Poultry Production	Stuart Gage	Michigan State University	46,942	25,204	2 years
				TOTAL ACE	385,672.00	378,857.00	
				TOTALS BOTH LISA and ACE	1,387,527.00	1,452,934.00	

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Table 3. ACE Funds Granted to Each State of the North Central Region in FY-1992

ACE - 1992 Funding

STATES AND ORGANIZATIONS-1992 FUNDING	ACE FUNDS	MATCHING FUNDS
ILLINOIS		
Farmer Grants	2,951	14,902
INDIANA		
Farmer Grants	3,620	4,600
IOWA		
Farmer Grants	6,600	8,272
KANSAS		
Farmer Grants	16,753	96,386
MICHIGAN		
Michigan State University	46,942	25,204
MINNESOTA		
University of Minnesota	67,000	80,600
Farmer Grants	3,979	9,802
MISSOURI		
NEBRASKA		
University of Nebraska	99,500	168,653
Farmer Grants	11,500	23,414
NORTH DAKOTA		
OHIO		
SOUTH DAKOTA		
South Dakota State University	104,000	68,000
WISCONSIN		
Wisconsin Rural Development Center	68,230	36,400
Farmer Grants	9,611	15,050
TOTALS Projects	$385,672.00	$378,857.00
Farmer Grants	55,014.00	172,426.00
Grand Total	$440,686.00	$551,283.00

Table 4. SARE Funds Granted to Each State of the North Central Region in FY-1992

STATES AND ORGANIZATIONS-1992 FUNDING	SARE FUNDS	MATCHING FUNDS
ILLINOIS		
Illinois Sustainable Agriculture Society	10,000	4,300
University of Illinois	72,018	58,037
IOWA		
Practical Farmers of Iowa	75,867	169,395
Southern Iowa Forage and Livestock Committee	12,445	14,200
KANSAS		
Farmer Grants	6,585	9,600
MICHIGAN		
Michigan State University	42,410	48,370
Farmer Grants	2,020	17,050
MINNESOTA		
Sustainable Farming Association	120,000	117,900
Farmer Grants	5,995	7,851
MISSOURI		
University of Missouri-Columbia	164,494	151,011
NEBRASKA		
University of Nebraska-Projects	124,081	133,971
University of Nebraska-Administration		
NORTH DAKOTA		
North Dakota State University	113,000	113,150
Farmer Grants	4,400	8,700
OHIO		
Ohio State University Research Foundation	112,390	148,579
Ohio State Univ. Rsch. Fdn.-Extension Demo.	46,588	44,117
Farmer Grants	2,430	12,550
SOUTH DAKOTA		
South Dakota State University	47,150	49,500
WISCONSIN		
Wisconsin Rural Development Center	108,000	79,480
Farmer Grants	5,785	7,000
TOTALS Projects	$1,001,855.00	$1,087,893.00
Administration	89,584.00	-
Extension Demonstration	46,588.00	44,117.00
Farmer Grants	27,215.00	62,751.00
Grand Total[1]	$1,165,242.00	$1,194,761.00

[1] Total does not include $28,412 for pending Extension Demonstration project and funds allocated for National Initiatives.

1992

North Central Region
Sustainable Agriculture
Research and Education Program

Strategic Plan

Research
Education
Implementation

Illinois	Missouri
Indiana	Nebraska
Iowa	North Dakota
Kansas	Ohio
Michigan	South Dakota
Minnesota	Wisconsin

RATIONALE

The twelve states — Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin — that make up the North Central Region represent the heart of the American agricultural system. The Region contains what most Americans think of when they think of the traditional family-farm heritage of the country. In a real sense, this is the burden carried by this part of the country — that is, to maintain this heritage in a contemporary form. The major challenge confronting those organizations and individuals with leadership responsibilities is to determine just what the appropriate forms should be and how to proceed to develop them.

This challenge is complicated today by changes in the structure and leadership of agriculture. For some decades, agriculture has been the domain of large farm-related organizations working in concert with agri-business interests, some with broad agendas, many with narrower ones. While there are a variety of ideologies represented within this system, over time, structures and processes for resolving differences have been developed so there has been a degree of predictability in the system. That is no longer the case. Agriculture has caught the attention of a whole new range of organized interests, some representing farmers actively seeking alternatives to the policies and practices embedded in the conventional system, others having no direct connection with farming, but voicing concerns which ultimately find expression in agricultural policy discussion. Environmental groups, food safety groups, animal rights groups, et al, each drawing heavily upon non-farm constituencies for their support and direction, are becoming powerful forces to reckon with in the shaping of American agriculture's future. And nowhere will this be more evident than in the agricultural heartland of the country — the North Central Region.

Sustainable agriculture[1], by fate or by choice, has become the crossroads for many with this complex mix of interests. The very ambiguity of the term "sustainable" provides the broad framework within which exists the potential for developing a vision of the future to which the diverse groups of stakeholders may subscribe.

The Sustainable Agriculture Research and Education Program is one of the major federal initiatives focusing on balancing economic, environmental and social concerns related to sustainable farming and ranching. It has congressional mandates, modest resources and regional discretion with which to pursue a regionally defined agenda. It has been structured as a decentralized partnership between the formal agricultural research and education establishment and the broad range of community interests involved in agriculture. This set of dimensions provides opportunities for setting valid agendas and encouraging the active engagement of diverse food and farm stakeholders in the learning process that can ultimately lead to a new vision for American agriculture policy and practice, a vision that is firmly rooted in sustainability.

Mission Statement

The mission of the North Central Region's Sustainable Agriculture Research and Education Program is to create and manage a system designed to encourage the involvement of farm and non-farm citizens in the process of discovery and learning that leads to achieving a more sustainable, environmentally-benign agriculture. This is congruent with the national legislation which created the USDA/Cooperative State Research Service (CSRS) research and education grant program entitled "Low-Input, Sustainable Agriculture" (LISA) and the joint USDA/CSRS, EPA research and education grant program entitled "Agriculture in Concert with the Environment" (ACE).

[1]Subtitle B of Title XVI of the Food, Agriculture, Conservation and Trade Act of 1990 authorizes research and education programs in Sustainable Agriculture and defines sustainable agriculture as an "integrated system of plant and animal production practices having a site-specific application that will, over the long-term: 1) satisfy human food and fiber needs; 2) enhance environmental quality and the natural resource base and fiber needs; 3) make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; 4) sustain the economic viability of farm operations; and 5) enhance the quality of life for farmers and society as a whole."

GOALS

1. To develop and refine a process for identifying research and education priorities relevant to the differing needs and conditions existing within the North Central Region.

2. To develop and encourage innovative models of mutual learning and research related to the participatory system articulated in the North Central Region mission statement.

3. Support research and education projects that contribute to the development of sustainable farming systems and communities and enhance the quality of the environment throughout the North Central Region.

Objectives: 1992-96

1. To develop a flexible grant-making system designed to provide for effective targeting of grants across a broad range of research and education interests and needs in the region.

2. To create a system for encouraging and affirming individual, team and institutional accomplishments in the field of sustainable agriculture research and education in the region.

3. To establish a regionwide system for setting relevant research and education priorities to be used in developing the LISA/ACE Call for Preproposals/Proposals and in the subsequent evaluation and funding decisions.

4. To develop strategies for broadening the scope and strengthening the impact of program funding through linkages with other public and private research and education resources.

5. Strengthen the quality of the North Central Region's grant making by developing effective mechanisms for obtaining valid feedback from grant applicants, successful or not, and from other regional stakeholders.

Action Plans

Regional Initiatives: 1992-93

1. Restructure the North Central Region Sustainable Agriculture Research and Education grant-making program to incorporate the following features:

   1.1 Planning grants to encourage the development of interdisciplinary and cross-functional research projects capable of attracting financial support from a variety of sources including LISA, ACE, the National Research Initiative and others.

   1.2 Special interest grants designed to fill specific regional research and education needs as determined by the Administrative Council through its review of information gathered from previous grant rounds, Technical Committee feedback and other sources.

   1.3 Sponsorship grants to support the region's outreach and participatory objectives.

   1.4 Partitioning of the funding pool to reflect the addition of categories identified in 1.1, 1.2 and 1.3 to the annual Call for Preproposals/ Proposals currently used by the North Central Region Administrative Council.

2. The Administrative Council should annually evaluate the status of priority issues for LISA and ACE and revise and identify new priority issues and/or areas of special interest. For 1992-93, those issues are identified as:

   2.1 *LISA.* Research and demonstration projects on how innovative farming systems can be used to meet the sustainable agriculture provisions of the 1990 Farm Bill; research to evaluate the farm level economic costs of benefits of participating in these provisions; their effectiveness in fostering the adoption of agronomically and ecologically sound farming systems; and policy options for improving their effectiveness. Important examples include the Integrated Farm Management Program option and new options for the Conservation Reserve Program including alley cropping on enrolled land and enrollment of contour grass strips, filter strips and field windbreaks.

2.2 *LISA.* Research, education and demonstration projects on innovative approaches to community development focused on sustainable agriculture, including strategies aimed at increasing profitable self-employment opportunities in farming, farm-related businesses and enhancing the quality of life for farmers and society as a whole. This may include development and demonstration of innovative approaches to education and technology transfer that are particularly effective in stimulating establishment of farms and businesses focused on sustainable agriculture.

2.3 *ACE.* Research and demonstrate alternative scenarios for managing waste from feedlots and confinement operations that 1) do not adversely affect surface or groundwater quality, and impair drinking water, and/or 2) maintain aquatic habitats (sediment, nutrients and pesticides), and/or 3) demonstrate new and beneficial uses for animal wastes.

2.4 *ACE.* Research and demonstrate the compatible interaction of agricultural requirements and ecological/environmental values for environmentally sound multiple land uses involving:

1) conservation reserves,
2) riparian zones,
3) wetlands,
4) highly erodible soils,
5) windbreaks,
6) ground water recharge zones, and
7) composting.

2.5 *ACE.* Research and demonstrate non-chemical methods for controlling pests.

2.6 *ACE.* Develop, refine and calibrate techniques to control the misuse of nitrogen and phosphorus fertilizers to protect ground and surface water.

2.7 *ACE.* Promote research in and demonstration of farm/ranch systems that promote avian, terrestrial and aquatic species abundance and diversity.

3. Develop and implement strategies designed to acquire program time on state and regional meeting agendas of targeted specific interest groups such as agronomists, weed scientists, sustainable agriculture organizations, et al.

4. Encourage state and regional groups to co-sponsor and organize meetings which bring together a broad spectrum of sustainable agriculture stake holders for purposes of potential grantseeker orientation, North Central Region priorities identification and "showcasing" program achievements/results.

5. Create and support a regional speakers' bureau made up of Administrative Council and Technical Committee members and interested investigators of funded projects who can be available on a proactive basis to speak to groups, meetings and conferences in the region on sustainable agriculture issues and issues related to regional programs and goals.

6. Develop a North Central Region news service to serve as a vehicle for expanding access to research results, funded projects, regional activities related to goals, current regional priorities, etc. through existing regional media outlets.

7. Develop a plan for a North Central Region Sustainable Agriculture Research and Education Fellows program to recognize project investigators who have done an exceptional job of fulfilling the intent and objectives of the program.

8. Cooperate and coordinate with the Sustainable Agriculture Network to develop and maintain a computer database of all submitted proposals and funded projects.

9. Conduct a review of the makeup of the Administrative Council and the Technical Committee to assure that current representation adequately reflects the program scope and emphasis outlined in the strategic plan.

National Initiatives: 1992-93

The Administrative Council will cooperate in the regional implementation of these national initiatives:

1. Sustainable Agriculture Development-Demonstration Initiative

2. Water Quality Program (Nitrogen Testing Initiative)

3. National Economic Implications of Sustainable Agriculture

4. Sustainable Agriculture Quality of Life Task Force

Attachment A. Administrative Council and Technical Committee

Administrative Council Members, 1992 and 1993

Name and Address:		Representing:	Nominating Authority:
Dr. Don A. Holt Agricultural Experiment Station University of Illinois at Urbana-Champaign 211 Mumford Hall 1301 West Gregory Drive Urbana, IL 61801	1991-92 1992-93	Agricultural Experiment Station	Director, Agricultural Experiment Station
Dr. Eldon E. Ortman Indiana Ag Experiment Station Purdue University 1140 Ag Administration Building West Lafayette, IN 47907-1140	1991-92 1992-93	Agricultural Experiment Station	Director, Agricultural Experiment Station
Dr. Jerald DeWitt R-108 Curtiss Hall Iowa State University Ames, IA 50021	1991-92	Cooperative Extension	Administrator, Cooperative Extension Service
Dr. Hans Kok Department of Agronomy 219 Throckmorton Hall Kansas State University Manhattan, KS 66506	1991-92 1992-93	Cooperative Extension	Administrator, Cooperative Extension Service
Dr. Bernie Knezek Department of Crop & Soil Science Michigan State University East Lansing, MI 48824	1991-92	Agricultural Experiment Station	Director, Agricultural Experiment Station
Ken Taylor Minnesota Food Association 2395 University Ave. #309 Saint Paul, MN 55114	1991-92 1992-93	Non-Profit Organization	Regional Administrative Council

George Enlow Cooperative Extension Program 1890 Extension Programs Lincoln University 900 Moreau Drive Jefferson City, MO 65101	1991-92	1890 Extension	Administrator, Cooperative Extension Service
Gary Young Nebraska Sustainable Agricultural Society RR 1, Box 27 McLean, NE 68747	1991-92 1992-93	Farmer/Producer	Regional Administrative Council
Fred Kirschenmann Northern Plains Sustainable Agriculture Society RR 1, Box 73 Windsor, ND 58493	1991-92 1992-93	Farmer/Producer	Regional Administrative Council
Clive Edwards 1735 Neil Avenue Ohio State University Columbus, OH 43210	1991-92 1992-93	Agricultural Experiment Station	Director, Agricultural Experiment Station
Raymond Berry P.O. Box 116 Norris, SD 57560-0116	1991-92 1992-93	Farmer/Producer	Regional Administrative Council
Dr. Richard Klemme Center for Integrated Agriculture Systems 240 Ag Hall College of Ag & Life Sciences University of Wisconsin - Madison Madison, WI 53706	1991-92 1992-93	Cooperative Extension	Administrator, Cooperative Extension Service
Eldean Gerloff USDA-ARS Midwest Area 1815 North University Street Peoria, IL 61604	1991-92 1992-93	Agricultural Research Service	Director, Agricultural Experiment Station
August J. Dornbusch, Jr. Dir. of Midwest National Technical Center Federal Bldg., Room 345 100 Centennial Mall North Lincoln, NE 68508-3866	1991-92	Soil Conservation Service	Administrator, Soil Conservation Service
Mr. Karl Stauber Northwest Area Foundation 332 Minnesota Street Suite E1201 Saint Paul, MN 55701-1373	1991-92 1992-93	Non-Profit Organizations	Regional Administrative Council

Harry Wells Pollution Prevention Office US EPA 401 M St. SW, MC 7409 Washington, DC 20460	1991-92 1992-93	Environmental Protection Agency	Administrator, Environmental Protection Agency
New 1992-93			
Ken H. Holscher Department of Entomology 102 Insectary Building Iowa State University Ames, IA 50011-3140	1992-93	Cooperative Extension	Administrator, Cooperative Extension Service
Tom Guthrie 7301 Milo Delton, MI 49046	1992-93	Farmer/Producer	Regional Administrative Council
Dr. Frieda Eivazi Cooperative Research Lincoln University 103 Dickinson Research Center Jefferson City, MO 65101	1992-93	1890 Research	Administrator, Cooperative Extension Service
Bradley T. Brummond Walsh County Extension County Road 12B, Box 29 Park River, ND 58270	1992-93	Cooperative Extension	Administrator, Cooperative Extension Service
Dr. Clarence M. Maesner National Rural Development Specialist Soil Conservation Service 511 N.W. Broadway, Rm. 248 Portland, OR 97709-3489	1992-93	Soil Conservation Service	Administrator, Soil Conservation Service
Patrick Madden 1207 Campbell St. Glendale, CA 91207	1992-93	SARE Associate Director, CSRS	Administrator, Cooperative State Research Service

Technical Committee Members 1992 and 1993

Technical Committee members represent a broad range of backgrounds and expertise. They include producers, scientists, researchers, and representatives of non-profit agricultural groups, extension, and government agencies. In reviewing and ranking preproposals and proposals, they provide significant input as to a project's technical viability by evaluating the following attributes:

1) suitability of objectives;
2) potential significance;
3) feasibility;
4) general components of technical design;
5) budget; and
5) overall project merit.

In making its recommendations, the Technical Committee also considers comments from outside reviewers on each project. This input provides an even greater degree of information with which the Technical Committee can formulate its recommendations.

John M Gerber Agricultural Experiment Station 206B Vegetable Crops Building 1103 West Dorner Drive University of Illinois Urbana, IL 61801	1992	Co-Chair 1991-92
Sonya Salamon University of Illinois-Urbana Human Resources & Family Studies 1105 West Nevada Street Urbana, IL 61801	1992 1993	
Phillip Pope Forestry & Natural Resources Purdue University West Lafayette, IN 47907	1992 1993	
Richard Thompson Practical Farmers of Iowa RR 2, Box 132 Boone, IA 50036	1992	
Jerry Jost Kansas Rural Center RR 3, Box 116 Lawrence, KS 66044	1992 1993	Co-chair 1992-93

Chuck Hassebrook Center for Rural Affairs Box 405 Walthill, NE 68067	1992	Co-Chair 1991-92
Harlan Hughes Agricultural Economics North Dakota State University State University Station Fargo, ND 58105	1992	
Charles Nelson Nelson's Brothers Farms HC 1, Box 10 Ayr, ND 58007	1992 1993	
Richard R. Harwood Crop & Soil Science Department Michigan State University 260 Plant & Soil Sciences Building East Lansing, MI 48824	1992 1993	
Richard Ness Land Stewardship Project 180 E. Main Street Lewiston, MN 55952	1992 1993	
John Ikerd Professor Ag. Economics University of Missouri 211 Mumford Hall Columbia, MO 65211	1992 1993	
Rex Spray Spray Brothers Farm RR 3, 5960 Spray Lane Mt. Vernon, OH 43050	1992 1993	
Benjamin Stinner The Ohio State University Department of Entomology Wooster, OH 44691	1992 1993	
Charlie Johnson RR 2, Box 29 Madison, SD 57042	1992 1993	

M. P. Russelle ARS, Soil & Water Management Unit 439 Borlaug Hall University of Minnesota 1991 Upper Buford Circle St. Paul, MN 55108	1992 1993	
Arnold Mendenhall Conservation Agronomist Federal Building 100 Centennial Mall North Lincoln, NE 68508-3866	1992 1993	
Julie Elfving USEPA Region VII MPS Coordinator 726 Minnesota Avenue Kansas City, KS 66101	1992 1993	Co-Chair 1992-93
John B. Masiunas 206 Plant & Animal Biotechnology 1201 West Gregory Drive University of Illinois Urbana, IL 61801-3838	1993	
Ronald L. Rosmann Route 1, Box 177 Harlan, IA 51537	1993	
Elizabeth Ann R. Bird Center for Rural Affairs Box 406 Walthill, NE 68067	1993	
Alice Coley Dobbs Schafer Edinburg Farms, Inc. Rt. 5, Box 33 Trenton, MO 64683	1993	
Fred H. Buttel 350 Agricultural Hall University of Wisconsin-Madison Madison, WI 53706	1993	
Diane H. Rickerl Plant Science Department Box 2109 South Dakota State University Brookings, SD 57007	1993	

Areas of Technical Reviewer Expertise

Agricultural Economics
Agricultural Engineering (Waste Management)
Agricultural Engineering (Soil/Water Conservation)
Agronomy (Forage Crops)
Agronomy (Agronomic Crops)
Agronomy (Cover crops and legumes)
Agronomy (Soil Fertility)
Agronomy (Conservation Tillage)
Animal Science (Production)
Anthropology
Ecological Sciences
Entomology (Agronomic Crops)
Entomology (Horticultural Crops)
Family Farm Agricultural Production
Forestry/Agroforestry
Horticulture (Vegetable Crops)
Horticulture (Fruit Crops)
Marketing (Horticultural production)
Plant Pathology (Agronomic Crops)
Plant Pathology (Horticultural Crops)
Policy Analysis
Poultry Science (Production)
Rural Sociology
Sustainable Agricultural Systems
Toxicology
Water quality
Weed Science (Agronomic Crops)
Weed Science (Horticultural Crops)
Whole farm analysis
Wildlife Habitat

Attachment B. Site Reviews Conducted in 1991 and 1992

FY 1991 Site Reviews Conducted

LNC90-28: The Krusenbaum Farm -- A Case Study and Model in the Establishment of an Organic Dairy.
Duration: 2 1/2 years
CSRS Funding: $70,748
Project Coordinator:

Joshua Posner
Agronomy Department
University of Wisconsin
1575 Linden Drive
Madison, WI 53706
(608) 262-1390/1391

Site Visit Reviewer: Warren Sahs
Site Visit Date: May 23, 1991

FY 1992 Site Reviews Conducted

LNC90-32: Rotational Grazing Systems for Wisconsin and Minnesota Livestock Farmers- An Evaluation of Animal and Forage Performance and Whole Farm Economic Ananlysis.
Duration: 2 years
CSRS Funding: $118,700
Project Coordinator:

Craig Sheaffer
University of Minnesota
Department of Agronomy and Plant Genetics
411 Bourlag Hall
St. Paul, MN 55108
(612) 625-7224

Site Visit Reviewers: Rick Klemme, Steve Stevenson and Dave Combs
Site Visit Date: June 12, 1992

LNC91-36: Project to utilize CRP land to demonstrate livestock grazing systems that will be an economically feasible and environmentally sound alternative to row cro production on highly erodible land at the completion of the CRP contract.
Duration: 2 years
CSRS Funding: $40,340
Project Coordinator:

William Riley
Southern Iowa Forage and Livestock Committee
701 Davis Avenue
Corning, IA 50841
(515) 322-3101

Site Visit Reviewer: Ken Holsher
Site Visit Date: August 30, 1992

LNC91-41: Legume Management Research for VA Mycorrhizal Enhancement in Potato Production.
Duration: 2 years
CSRS Funding: $96,000
Project Coordinators:

George Bird/Gene Safir
Department of Botany and Plant Pathology
Michigan State University
East Lansing, MI 48824

Site Visit Reviewers: North Central Region Administrative Council
Site Visit Date: November 6, 1992

In addition, the Administrative Council, while meeting in Wisconsin, heard a report from the investigators of the following project:

LNC88-12. Whole Farm Economic Analysis of Medium-Sized, Single-Famly Dairy Farms that Differ in Their Use of Purchased Chemical Inputs

Duration: 1 year
CSRS Funding: $68,220
Project Coordinator:

Marvin Kamp
Wisconsin Rural Development Center

Reviewers: North Central Region Administrative Council
Date: June 12, 1992

Attachment C. Summary Statistics on Preproposals Accepted for Development of Full Proposals in Funding Year 1992-93

Total SARE/ACE Dollars Requested	$ 11,977,769.
Total Non-Federal Matching Funds	$ 10,822,587.
Total Federal Matching Funds	$ 3,013,099.

Preproposals Received, total	154
ACE Preproposals	38[2]
SARE(LISA)	117

State	Number of preproposals submitted:
Illinois	16
Indiana	9
Iowa	18
Kansas	5
Michigan	14
Minnesota	14
Missouri	7
Nebraska	32
North Dakota	3
Ohio	10
South Dakota	10
Wisconsin	15
Other	1

Types of preproposals	Number received for each program:	
	ACE:	SARE
Educational	12	19
Demonstration	5	16
Experimental Component	7	35
Exploratory Component	3	6
Integrated Systems	7	32
Impact Assessement	3	10

[2] Preproposal number 149 is included in both SARE and ACE categories.

PART II. SARE PROJECTS FUNDED, 1988 to 1993

Table of Contents of PART II

The following section provides descriptions of all the North Central Region LISA and subsequently SARE projects funded from 1988 through 1993, including results from the progress reports received in 1992.

LNC88-1: INTEGRATION OF CONSERVATION TILLAGE, ANIMAL MANURES, AND CULTURAL PEST CONTROL IN CORN

(Final Report)

Major Participants:

University of Minnesota: David A. Andow (Project Coordinator), Entomology, St. Paul, MN 55108, Phone: (612) 625-5000. John F. Moncrief, Extension; James B. Swan, Soil Science, Extension.

Farmer Participants:

Dale Flueger, dairy, and Don Nord, hogs, Goodhue County, MN.

Overview

Three farm technologies contribute greatly to the farm, social, and environmental cost of agricultural production: (1) tillage, which consumes large amounts of energy and leaves the soil open to erosion; (2) anhydrous ammonia, which embodies large amounts of energy and can pollute water resources; and (3) pesticides, which disrupt natural controls and are a human health hazard. Conventional practices for corn production in the rolling topography and karst formations of southeastern Minnesota include chisel plow for tillage, "disposal" of farm yard manures (hog and dairy) on alfalfa and fertilized corn land in the fall and spring, widespread use of herbicides, and frequent use of corn rootworm insecticide on second- and third-year corn. In addition, losses to European corn borer (*Ostrinia nubilalis*) are usually tolerated because control is difficult. The goal of this project was to explore, evaluate and develop integrated low-input management systems for corn production in southeastern Minnesota. One potential cropping system that could reduce soil erosion, limit nitrate and pesticide contamination of groundwater, and improve farm profitability is ridge-tilled corn fertilized with manures.

Experiments addressed three major issues:

1) What effects of manures on crop yield carry over from one year to the next in ridge-till corn? Given these carryover effects, what is the relation between rates of manure application and corn production?

2) What is the rate of nitrate leaching in ridge-tilled corn from manures with different frequencies of application and how do they compare with synthetic fertilizers? What manure treatments result in higher levels of soil organic matter and large pools of potentially mineralizable nitrogen?

3) Do reasonable rates of applications of manure affect survival of corn rootworms or

attack by European corn borer and do these relations change with tillage? Do manures and tillage affect weed populations?

Objectives

1. Explore and evaluate management alternatives for low-input corn production using ridge-tillage and farm manures.

2. Investigate the potential for reducing nitrate and pesticide pollution of groundwater by substituting manures for anhydrous ammonia.

3. Determine whether reasonable rates of applications of manure and different tillage practices affect survival of corn rootworms, attack by European corn borer and weed populations.

Results

These issues were examined in experiments on farms in southeastern Minnesota: a dairy operation owned by Dale Flueger (Goodhue County) and a farrow to finish hog operation owned by Don Nord (Goodhue County). To evaluate how the effects of applications of manures persist after the year of application, treatments were selected whereby fertilizers were applied in alternating years. These treatments were the swine manure and synthetic nitrogen plots at the Nord Farm and selected dairy manure plots at the Flueger Farm. The data, while limited to a relatively small number of comparisons, indicated that the effects liquid dairy manure persisted for two years unabated. These plots had a long history of application of liquid dairy manure in alternating years, and the results may be indicative of a steady state situation. Effects of adding liquid swine manure, however, did not persist. The effects of synthetic nitrogen fertilizer applications persisted more than those of liquid swine manure.

At the Nord Farm use of alternating applications of synthetic nitrogen fertilizer instead of alternating applications of liquid swine manure resulted in a 23 and 27 bushel per acre yield gain in ridge-tilled and chisel-plowed corn, respectively. At the Flueger Farm, annual applications of synthetic nitrogen fertilizer yielded 13 bushels per acre more than use of alternating applications of liquid dairy manure in both no-tilled and chisel-plowed corn. The synthetic nitrogen treatment yielded 13 bushels per acre less than annual applications of liquid dairy manure in no-till corn, and 1 bushel per acre less in chisel-plowed corn.

Tensiometer and nitrate concentration measurements were available for only part of the 1989 crop year for the treatments receiving synthetic nitrogen fertilizer. Relatively small amounts of nitrogen were estimated to be leached because water movement was small during the measurement period. Most of the calculated nitrate leaching occurred earlier in the year.

Potential nitrogen losses to groundwater were evaluated by examining nitrate concentrations at a soil depth of about 150 cm. Summaries of results indicated that nitrate concentrations were 1.5-2.0 times higher under ridge-tillage than chisel plow at the Nord Farm. Concentrations were three to eight times higher when synthetic fertilizers were used compared to alternating applications of liquid swine manure at the Nord Farm. At the Flueger Farm, nitrate concentrations were 1.5-2.0 higher with annual applications of synthetic nitrogen fertilizer than with annual applications of liquid dairy manure and four to ten times higher with synthetic nitrogen than with alternating applications of dairy manure.

Researchers also evaluated which fertilizer treatments resulted in higher levels of soil nitrogen. Total soil nitrogen was estimated from samples taken at several depths in the 0-5 ft. soil zone during the spring and fall of 1988-1990. To compare soil nitrogen levels among fertilizer treatments, the ratio of total nitrogen in the 0-5 ft. zone in each fertilizer treatment (averaged across tillage, because no consistent effect of tillage was observed) was compared to total nitrogen in the 0-5 ft. zone in the check treatment, which received no added fertilizer. Ratios were averaged across sample dates for each fertilizer treatment. More nitrogen accumulated in the soil under annual applications of synthetic fertilizer than any of the other fertilizer treatments. Application of dairy manure either annually or in alternating years resulted in some nitrogen accumulation, more so with annual application. Application of swine manure in alternate years did not result in any accumulation of soil nitrogen.

Substituting liquid dairy manures for synthetic fertilizer may lead to accumulation of nitrogen in the soil, but not as rapidly as use of synthetic fertilizers alone. Furthermore, research indicated that this accumulated nitrogen should be less likely to leach than the nitrogen under applications of synthetic nitrogen.

Previous research in central Minnesota showed that corn had less root injury from rootworms when solid dairy manures were applied than when synthetic fertilizers were applied. Our study failed to repeat this observation with the liquid dairy or liquid swine manures. Perhaps the lack of an effect of manures was related to the type of manure. Liquid swine manures contain relatively low quantities of organic matter and fixed nitrogen and liquid dairy manures contain less organic matter than solid dairy manures. Suppression of rootworm attack by adding manure may depend on considerable quantities of added organic matter.

To summarize the findings at the Nord farm, the effect of tillage was independent of the effect of fertility source in all measured outcomes. Fertilization with synthetic nitrogen gave about 25 bushels per acre more yield, but also allowed three to eight times greater nitrate leaching. There were no differences in rootworm injury. There was no difference in yield among tillages, but with ridge-till there was 1.5 to 2.0 times greater nitrate leaching. Although data from more years is needed to substantiate these trends, current data suggest that chisel plow is superior to ridge-till at this site because it presents less of a threat to groundwater, but that nitrate leaching three to eight times greater would be traded for 25 bushel per acre corn grain yield.

At the Flueger Farm, tillage and fertility regime had independent effects on relative nitrate leaching, and no effects on root injury. The highest yields were obtained with annual manure applications to no-till corn, but otherwise tillage had no effect on yield. Based on measured nitrate leaching rates, no-till with annual manure applications was the optimal production system, showing the greatest yield (170 bushels per acre) and the lowest leaching (1.2 lb nitrate per acre). Leaching rates, however, were low, and the relative leaching rates might give a better indication of true nitrate leaching among treatments. In this case there was a trade- off between annual applications of manures in no-till and biennial applications of manure in no-till. In general, no-till was superior to chisel plow at this site because it yielded better under some fertility regimes and probably leached less nitrate than chisel-plowed corn. The trade-off in manure applications was 26 bushel per acre corn grain yield for a 2- to 10-fold reduction in nitrate leaching. Again, these are preliminary conclusions that need to be substantiated by more data.

Project Duration: One year, ending in 1988

Funding: $98,500
Matching: $93,472

LNC88-2: AN ECONOMIC ANALYSIS OF PRODUCER AND INDUSTRY LEVEL IMPACTS OF LOW-INPUT AGRICULTURE

(Revised 1/14/91)

Major Participants:

Iowa State University: James Kliebenstein (Project Coordinator for Producer Level Impacts), Professor of Economics, Department of Economics, Heady Hall, Ames, IA 50011-1070, Phone: (515) 294-4111. Michael Duffy, Associate Professor of Economics, assisted in budget development.

University of Nebraska: Glenn Helmers, Professor of Agricultural Economics; Azzeddine Azzam, Assistant Professor of Agricultural Economics (Project Coordinators for Industry-Level Impacts).

Overview

The purpose of this study is to evaluate the economic impact on returns of using swine manure to meet crop nutrient needs on a typical midwest crop/livestock farm. Increased awareness and concern for environmental quality in recent years has increased pressure on farmers to develop and utilize methods to minimize the environmental impact of their production activities. The use of manure produced by livestock enterprises to meet crop nutrient needs is one method of reaching this goal.

An important concern of farmers in a crop/livestock operation is the lack of time to apply the manure during labor intensive periods. Availability of nutrients in the manure is highest when it is applied in spring, a labor-intensive time for producers planting crops. This project evaluates the economic trade-offs of hiring labor during this peak periods.

Objectives

This study simulates a typical Iowa crop/livestock farm. Crop enterprise choices compare a corn-soybean rotation to continuous corn. The swine enterprise is constrained to a maximum of 90 sows, farrowing twice a year. Various alternatives for fertilizer application are compared. They include commercial fertilizer application or manure application via a liquid spreader, stationary spray gun or delivery cord. Delivery cord is a method in which field injection equipment is attached to a continuous line directly to the manure storage system. Estimation of costs, returns, and labor requirements were prepared with Iowa State Extension budgets, existing research and discussion with producers using the respective systems. Enterprise budgets were developed and used to evaluate the farm level impacts of sustainable production alternatives.

The farm has 400 tillable acres with a farrow to finish total confinement hog facility. The hog facility has the capacity of 180 litters of hogs per year. Farm implements available, sizes, field capacities and labor requirements used are standard for an Iowa swine/corn operation as

suggested by the Iowa extension enterprise budgets.

All manure was applied and used to meet nitrogen, phosphorus, and potassium requirements. Commercial application was used to bring levels of nutrients to satisfactory rates when manure supplies are exhausted or uneconomical. Four separate manure application time alternatives were considered. They were: all in spring; split with half in the spring and half after harvest with immediate incorporation; fall with immediate incorporation; and winter.

Project Duration: Two years
Funding: $25,000
Matching: $31,824

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Iowa State University, $12,500, ($16,412)
University of Nebraska, $12,500, ($15,412)

LNC88-3: LOW-INPUT RIDGE TILLAGE SYSTEM FOR THE CORN BELT

Major Participants:

Ohio State University: Randall Reeder (Project Coordinator), Agricultural Engineering, Columbus, OH 43210, Phone: (614) 292-6648. Don Eckert, Agronomy; Craig Fendrick, Farm Operations; Larry Whiting, Head, Information; Allan Lines, Agricultural Economics; Clive Edwards; Ben Stinner; Nancy Creamer, Entomology; Robert Holmes; Erdal Ozkan, Agricultural Engineering.

USDA/Agricultural Research Service: Norman Fausey.

Purdue University: Don Moore, Cooperative Extension; Samuel Parsons; Donald Griffith.

Farmer Participants:

Dale McNelly, Ohio; Donn Klor, Illinois; John Alexander, Indiana; Carl Eppley, Indiana.

Overview

Where ridge tillage is successful, crop yields are maintained or increased. Corn and soybean yields are usually maintained and often increase, especially on poorly drained or compacted soils. Production costs (notably herbicide and tillage costs) are reduced; less use is made of tractors and machinery, thus lowering costs for repairs, maintenance and fuel; and less labor is required. Because herbicide rates and costs are reduced by two-thirds, environmental impacts are reduced. Crop residues between the ridges minimize erosion and movement of chemicals into waterways. Agronomic research and economic analysis shows that ridge tillage is profitable on at least half of the corn/soybean land in the region. The purpose of this project was to determine more explicitly those conditions where ridge tillage can provide an economic

and environmental improvement over conventional tillage practices.

Objectives

1. Establish a permanent low-input ridge tillage system on 175 acres of continuous corn and corn-soybean rotation at the site of the Ohio Farm Science Review.

2. Educate farmers in Ohio, the North Central Region and the world about low-input ridge tillage.

Project Duration: One year, ending in 1989
Funding: $24,300
Matching: $70,899

LNC88-4: SUSTAINABLE LOW-INPUT AGRICULTURE: AN OVERVIEW VIDEOTAPE

Major Participants:

University of Nebraska: Dr. Charles Francis (Project Coordinator), Agronomy Department, Phone: (402) 472-7211. Dr. Myra Wilhite, Ag Communications; Dr. James W. King, Extension, Ag Communications.

Overview

Low-input or sustainable agriculture faces an educational challenge equally as important as those in production practices, economic analysis, and institutionalization of the process. This video is directed toward education of farmers and ranchers involved with crop and livestock production, students at high school and college level, legislators, agribusiness leaders, and educators within the land-grant system.

Objectives

The objective of this videotape project on sustainable/low-input agriculture was to provide an educational video for audiences which would:

- give a suitable definition of sustainable agriculture;
- describe examples of sustainable farming practices;
- discuss sustainable agriculture issues and practices in differing regions;
- list ways to use sustainable agricultural techniques in some specific farming systems;
- emphasize the profitability and long-term ecological advantages of sustainable agriculture.

Results

A video was developed to instruct producers and students about sustainable agriculture, as set forth in the objectives above. Through research at the University of Nebraska a series of recommendations were developed to help producers fine tune their fertility and pest management, to minimize tillage, and to explore alternative crops. These recommendations are presented in this 23-minute videotape that was produced by the Nebraska Educational Television Network. It was designed to serve as an introduction to several more specific videos being developed by Iowa State University under LISA funding.

Project Duration: One year
Funding: $16,800
Matching: $24,187

LNC88-5: LOW-INPUT AGRICULTURE AND COVER CROP WORKSHOP FOR EXTENSION AND RESEARCH PERSONNEL FROM NEBRASKA, IOWA, KANSAS AND MISSOURI

Major Participants:

University of Missouri: Zane Helsel, Agronomy (no longer at the University of Missouri); Tory Shade, Extension, area farm management, Phone: (314) 224-3221.

University of Nebraska: Richard Ferguson, Agronomy; Roger Selley, Agricultural Economics; Charles Francis, Agronomy.

Kansas State University: David Whitney, Agronomy.

Iowa State University: Regis Voss, Agronomy.

Farmer Participants:

Ed Peak, Iowa; Richard Thompson, Iowa; Gary Ellington, Missouri; Ron Ellermeier, Nebraska; Dennis Ruhnke, Kansas

Overview

Producers, researchers, extension staff and representatives of private organizations were invited to participate in a workshop on sustainable agriculture in the region. Academic disciplines represented were crops, soils, weeds, insects, diseases, livestock, agricultural economics/farm management, rural sociology, administration and systems. Organization representatives of Practical Farmers of Iowa, Kansas Rural Center, and Rodale Institute On-Farm Research Program were invited to help university researchers and extension staff understand practical on-farm LISA realities.

Objectives

1. For participant/speakers to present and become aware of what information and resources are available on LISA technologies, especially from the four-state area, including Kansas, Iowa, Nebraska, and Missouri.

2. To provide an opportunity for participants to develop interdisciplinary networks for future cooperation in programs, research, and grant proposals (especially cover crops).

3. For participants to start planning how the information presented during the workshop will be used for future research and educational activities.

Results

The principal coordinators organized a four-state LISA Workshop that was held at St. Joseph, Missouri from April 3-5, 1989. Approximately 10 interdisciplinary participant/speakers were invited from each state. Special topics were covered by invited out-of-the-region speakers: Bill Hargrove from Georgia (Cover Crops) and Dixon Hubbard (National LISA Overview) from Extension Services/USDA, Washington D.C.

Major topics covered were cover crops, nutrient management strategies, reduced tillage/machinery management strategies, weed and cover management strategies, disease management strategies and insect management strategies. Additional topics were the USDA Low-Input Sustainable Agriculture Program (LISA), defining LISA, economic evaluation of LISA systems, livestock in LISA systems, animal manures, rotation benefits, on-farm testing, systems aspects of LISA, and adoption of LISA technologies.

The program included an overview of each major topic, followed by a 10-15 minute report from each state and discussion. Participants also met to discuss cooperating in a cover crops grant proposal and in teams to discuss the future research needs for LISA programs, how extension and researchers should assist producers with LISA programs, how extension and researchers should assist producers with LISA decision making and how the resource materials from the workshop could be used at home. A farmer panel highlighted concerns and suggestions for adoption of LISA technologies. During and after the workshop, participants evaluated the program. The overall rating was 1.4, with 1 being excellent and 5 being bad.

Team discussion reports highlighted the following needs for research and education: identify low-risk first steps for early adoption of LISA; conduct cover crop research -- screening of species and varieties, breeding, cultural development, pest systems, nitrogen release and relation to environmental quality; develop computer simulations of LISA systems as a learning tool and as an aid to decision making; continue sharing research information from state to state; continue sharing education resources from state to state; sponsor livestock trials on farms and at research stations; coordinate in-service training programs in the four-state area; (8) encourage more research on living mulches, alternative uses for legumes and effect of organic feed on cattle; (9) determine benchmark data with which researchers can compare LISA systems; (10) suggest ways to determine what a region can produce (on highly erodible land or with environmental constraints) that would be marketable; (11) research the impact of LISA on policies at state and federal levels and what role farmers, researchers and extension can play.

Project Duration: One year, ending in 1989
Funding: $16,500
Matching: $4,799

LNC88-6: DEVELOPMENT OF ORGANIC NITROGEN AVAILABILITY FUNCTIONS FOR A NITROGEN-MANAGEMENT MODEL

Major Participants:

University of Wisconsin: L.G. Bundy (Project Coordinator), Soil Science, University of Wisconsin Extension, Madison, WI 53706, Phone: (608) 262-1234. R.M. Klemme, Agricultural Economics and UW Extension; M.B. Vanotti, Soil Sciences.

Overview

This project evaluated Midwest experiments on availability of nitrogen in organic sources to corn and add organic nitrogen availability functions in a user-oriented nitrogen management model under development at Wisconsin. Development was initiated in 1986 and continued under this grant. The model has a large data base for continuous corn but a small data base for corn yield response to organic and nitrogen uptake from organic nitrogen sources such as legume residues, manure and sludge. The proposed research is to assemble available field data in the upper Midwest relating to use of organic nitrogen sources for crop growth, publish these as a regional review, and incorporate them into the model. The user model, termed the Nitrogen Management Decision Support System (NMDSS), is based on soil series, cropping history, past nitrogen management, and historic yield goal. Past weather, fertilizer nitrogen management, and tillage are being incorporated as the model develops.

Objectives

The specific objective of this project is to summarize field results on response of corn and other cereal grains to legume nitrogen sources and to incorporate appropriate organic nitrogen response functions into a Nitrogen Management Model for production agriculture in Wisconsin.

1. Develop a comprehensive nitrogen management model capable of providing predictions for maximizing crop use of available soil nitrogen, particularly nitrogen from organic sources through selection of optimal combinations of management variables. The model will also serve to minimize environmental problems, particularly groundwater contamination by nitrate associated with excess use of nitrogen.

2. Integrate research program with extension to facilitate development of the model for the needs of the users and the rapid transfer of the technology, and arrange user-testing.

Results

Results from this five-year study, part of which was funded by LISA, indicate that alfalfa can furnish the nitrogen fertilizer equivalent (or nitrogen credit) of 100 lb/acre and 38 lb/acre to the first and second year succeeding cereal crop, respectively. These compare to the 160 lb N/acre optimum nitrogen fertilizer rate needed for corn without nitrogen supplied from other sources. Results also indicate that soybeans provide the nitrogen fertilizer equivalent of 84 lb/acre to a following corn crop. However, there is a negative nitrogen effect in second year cereal grown after soybeans compared to continuous corn, which results in a nitrogen fertilizer debit of 28 lb/acre. A probable explanation for this soybean effect on nitrogen availability is that, unlike alfalfa, part of the observed nitrogen benefit of soybeans to first year succeeding corn is due to increased uptake of indigenous soil nitrogen, which in turn causes a decrease in nitrogen available to the second year cereal crop.

Project Duration: One year
Funding: $14,009
Matching: $20,809

LNC88-7: LOW-INPUT SUSTAINABLE AGRICULTURE DATA BASE AND INFORMATION SYSTEM

(Revised 3/16/91)

Major Participants:

University of Missouri: Tory Shade (Project Coordinator), Phone: (314) 224-3221; John Ikerd; and Zane R. Helsel (now at Rutgers University.
University of Nebraska: Charles Francis
Ohio State University: Nancy Creamer
Conservation Tillage Information Center: John Becherer
Minnesota TDI: Kris Sanda
Michigan State University: Oran Hesterman
Kansas State University: John Hickman
Practical Farmers of Iowa/ISU: Rick Exner
Iowa State University: Dennis Keeney
South Dakota State University: Robert Hall

Cooperators:

Kansas Rural Center: David Ebbert
North Dakota State University: Steve Edwardson
Land Stewardship Project: Ron Kroese
Wisconsin Rural Development Center: Denny Caneff
University of Illinois: Richard Ford
Iowa State University: Jerry DeWitt
University of Minnesota: Joe Zuzenco

Overview

Initiation and advancement of any new program must determine what is already known and provide that information to involved participants. The goal of this project was to provide a framework for the development of a computer-based information system which could be accessed by farmers directly or indirectly through those who work with farmers, primarily extension agents. Information on research results; educational events; materials and aids; and farmer-to-farmer or researcher experiences would be available for potential use by farmers and others to incorporate into American agriculture production and food systems.

Objectives

1. Representatives from the North Central states were to submit a state plan for contribution and management of the data base.

2. The system should interface, where appropriate, with private organizations, the National Agricultural Library, ATTRA, and the other three regions.

Results

A 19-member regional committee including producers and representatives from state and private organizations developed the following suggestions. The group recommended considering the following types of information for a computer database (ranked in order of importance): (1) semi-technical and extension publications; (2) journal and other refereed articles; (3) field day/meeting/annual project reports; (4) list of experts/expertise; (5) popular press articles (farm magazines, etc.); (6) farmer/researcher/service personnel "observations"; (7) message/question & answer board; (8) newsletter (include calendar of events, titles of new reports, etc.) to be printed on a cost-recovery basis; (9) calendar of events; and (10) list of related books, videotapes, suppliers, slide sets, and computer programs.

The group suggested that information meeting the above criteria: 1) could be submitted by anyone; 2) be of a defined length (i.e., 200 words) and be searched on key words, title, author, etc. A state, regional or national committee would develop a taxonomy and set specific guidelines for controlling content and length of time to remain in data base. The group recommended that the data base could be queried in a variety of ways through a computer. Users (farmers, researchers, etc.) would be encouraged to input information, events, and field observations. The findings of this project were used in the development of a national information dissemination initiative, the Sustainable Agriculture Network, funded by national SARE funds.

Project Duration: One year, ending Dec. 31, 1989
Funding: $5,000 in 1988
Matching: $8,156

LNC88-8: SUSTAINABLE AGRICULTURAL EDUCATION DISPLAY SYSTEMS

(Final Report)

Major Participants:

Ohio State University: Clive Edwards, Entomology, Phone: (614) 292-6446. Bill Lyon, Extension Entomologist; Nancy Creamer, Entomology; Kevin King, Farm Science Review Board; Emily Regnier, Agronomy; Erdal Ozkan, Agricultural Engineering; Ira Deep, Plant Pathology; Fred Hitzhusen, Agricultural Economics; David Zartman, Dairy Science; Gene Isler, Animal Science.

Overview and Results

This project was to design and construct sustainable agriculture educational displays to be used at the Farm Science Review Showcase of Ohio Agriculture and the International Conference on Sustainable Agricultural Systems, which were both being held in Columbus, Ohio, in September 1988. A committee was formed with representatives from almost every department in the University of Ohio College of Agriculture to design sustainable agriculture displays to be used as part of their departmental displays. In addition, a centralized display aimed at introducing the issues and defining "What is Sustainable Agriculture?" was built.

All of participants at the International Conference on Sustainable Agricultural Systems Conference (sponsored by Ohio State University, North Carolina State University and Pennsylvania State University) will attend the Farm Science Review and be exposed to these displays. The displays made a major contribution in publicizing sustainable agriculture and the LISA program in the North Central Region.

Project Duration: One year
Funding: $4,000 in 1988
Matching: $4,000

LNC88-9: AGRONOMIC AND ECONOMIC ANALYSES OF ALTERNATIVE SMALL GRAIN/ROW CROP PRODUCTION SYSTEMS FOR THE NORTHERN PLAINS

(Revised 1991)

Major Participants:

South Dakota State University: James D. Smolik (Project Coordinator), Plant Science Department, Box 2109, Brookings, SD 57007, Phone: (605) 688-4151. Plant Science Department: George Buchenau, Biological Control; Thomas Dobbs, Agricultural Economist; Diane Rickerl, Soil Management; Leon Wrage, Weed Specialist. Donald Taylor, Agricultural Economist, Economics Department.

Cooperators:

University of Minnesota: Kent R. Crookston, Agronomy, St. Paul, MN.

North Dakota State University: John C. Gardner, Research and Extension Center, Carrington, ND.

South Dakota State University: Robert G. Hall, Extension Agronomist; David D. Walgenbach, Professor, Research Entomologist.

University of Nebraska: Warren W. Sahs, Institute of Agriculture and Natural Resources, Lincoln, NE.

Montana State University: James R. Sims, Professor, Department of Plant and Soil Sciences, Bozeman, MT.

Farmer Participants:

Conventional Farmer: Kris Johnke, Madison, SD.

Organic Farmers: Alan Johnson, Madison, SD; Charles Johnson, Madison, SD; Fred Kirschenmann, President of Northern Plains Sustainable Agriculture Society, Windsor, ND.

Overview

This study emphasized post-transition analyses of systems studied during the transition (establishment) phase with the aid of Agricultural Experiment Station and LISA funds. The study is part of a long-term multidisciplinary investigation of alternative (low-input/sustainable) agriculture initiated in 1984 by South Dakota State University. This study compared the agronomic and economic sustainability of alternative, conventional and reduced-tillage farming systems. The alternative systems used primarily on-farm resources to meet crop nutrient needs and to control pests. The experimental systems, established in 1985, consist of three- or four-year crop rotations. The investigations also include an on-farm component. At the conclusion of this proposal we will have obtained eight years of on-farm data. This information should enable us to project with more precision the relative agronomic and economic sustainability of the various systems.

Objectives

1. Determine the long-term agronomic and economic performance of alternative (low-input/sustainable), conventional, and reduced-tillage farming systems.

2. Compare machinery utilization and costs for alternative and conventional farms.

3. Measure soil physical parameters, including soil strength, bulk density, moisture, pore size, and surface residues.

4. Measure weed, nematode, earthworm and soil microbe populations.

5. Increase opportunities for exchange of information regarding alternative farming systems among farmers, extension personnel, private organizations, and university researchers.

Results

The experimental systems include two studies. Study I emphasizes row crops and includes three crop rotation systems -- alternate (organic)(Alt), conventional (Conv) and ridge-till (R-T). Study II emphasizes small grains and also includes three systems -- alternate, conventional, and minimum-till (M-T). The 1990 soybean yields were not different between systems in either study, however, alternate corn yields in Study I were lower than conventional and ridge-till yields. Spring wheat yields in Study II did not differ between systems. These yield trends generally reflect previous years' results. Assessment of yields over the past six years indicates precipitation, not farming system, has been the dominant factor influencing yields. Yield data obtained in these studies was scaled up to a farm size typical for the study area, assuming 15% set aside, and used in an attempt to estimate the impact of wide-scale adoption of these alternative systems. Systems were compared on the basis of total biomass (dry weight of grain and alfalfa) removed from a system over the six-year period.

The alternate (organic) system in Study I produced 35 percent to 38 percent more than conventional and ridge-till, due in large part to the inclusion of alfalfa in the rotations. Relative to inputs, the conventional and ridge-till systems used approximately twice as much nitrogen and ten times more herbicide. The four-year alternative rotation in Study II includes clover handled as a green manure crop and forage is not removed. The total biomass (dry weight of grains) removed from the Alt system in Study II was 14 percent to 22 percent less than in the conventional and minimum-tillage systems. Inputs in the Alt system in Study II were drastically reduced. The conventional and minimum tillage systems used approximately 20 times more nitrogen and 10 times more herbicide. Weed populations, particularly foxtail, were higher in the Alt systems.

The greatest increases in soil organic matter (32 percent) occurred in the Alt and minimum-tillage systems in Study II. In 1990, the conventional systems were the most profitable in both studies, followed by the Alt. The reduced-till systems were least profitable. This project includes an on-farm component and over the six-year period there has not been a significant difference in corn yields between the alternate and conventional systems, however, soybean yields have been less in the alternate system. Soil strength in the alternate systems was significantly lower than in the conventional system.

Project Duration: Four years, ending in September 1992
Funding: $194,650: $66,700 in 1988-89; $60,000 in 1989-90; $67,950 in 1990-92
Matching: $240,750

Continuation

LNC88-9: AGRONOMIC AND WHOLE-FARM ECONOMIC ANALYSES OF ALTERNATIVE SMALL GRAIN/ROW CROP PRODUCTION SYSTEMS FOR THE NORTHERN PLAINS

Major Participants

South Dakota State University: James D. Smolik (Project Coordinator), Plant Science; Thomas L. Dobbs, Agricultural Economics; Diane Rickerl, Agroecologist; Thomas E. Schumacher, Soil Biophysics; Howard J. Woodard, Soil Fertility; Leon J. Wrage, Extension Agronomist; George W. Buchenau, Plant Pathologist; James R. Gerwing, Extension Soil Specialist.

Northern Plains Sustainable Agriculture Society: Terry Jacobsen, Wales, ND; Lyle Busch, Bristol, SD;

USDA, Northern Grain Insect Research Lab: Walter E. Riedell, Brookings, SD.

Overview

This study will complete agronomic and economic analyses of alternative (low input/sustainable), conventional, and reduced-till farming systems, and will place a major emphasis on the longer-term, post-transition effects following adoption of alternative systems. The study is part of a long-term multidisciplinary investigation of farming systems initiated in 1984 by South Dakota State University. A primary impetus for this study was individual farmers and groups of farmers, and their active involvement in the research has continued. The overall objective of this effort is to compare the agronomic and economic sustainability of the various systems. The alternative systems are legume-based, and use primarily on-farm resources to meet crop nutrient needs and to control pests. The conventional and reduced-till systems receive recommended inputs of fertilizer and pesticides. This study includes both on-farm and experiment station components. The study began as an on-farm study in 1984 and, in part because of questions arising from both farmers and researchers, was enlarged in 1985 to include experiment station trials.

Agronomic data on yields and cultural practices from both the on-farm and the experiment station study components are incorporated in whole-farm economic models by agricultural economists on the research team. This study will also compare machinery utilization and costs for alternative and more conventional systems. Also included in analyses are measurements of inputs, yields, soil physical properties, earthworms, nematodes, mycorrhizae, weeds, soil microbes, and disease suppressiveness.

When this project is completed, eight years of agronomic and economic data will have been compiled and analyzed for two "operation" and six "simulated" whole farms. The analyses will have covered five "transition" years (1985-1989) and three "post-transition" years (1989-92). Farmers, researchers, extension educators, and policy makers will have a much better understanding of the potential long-term agronomic, economic, and environmental sustainability of different farming systems in the Northern Plains' agroclimatic region where corn-soybean row crops and small grains (predominantly wheat) overlap. Some of the results will provide a basis

for focusing and designing the next phase of sustainable agriculture research in the Northern Plains.

Project Duration: One year (final year of five-year study), ending Aug. 31, 1993

LNC88-10: SUBSTITUTING LEGUMES FOR FALLOW IN U.S. GREAT PLAINS WHEAT PRODUCTION

Major Participants:

North Dakota State University: John C. Gardner (Project Coordinator), Carrington Research Extension Center, Box 219, Carrington, ND 58421, Phone: (701) 652-2951. Blaine Schatz, Research Agronomist, conducts controlled experiments at experiment station; Vern Anderson, Research Animal Scientist, conducts grazing studies of living mulches at experiment station; Dave Watt, Research Economist, Agricultural Economics Department, Morrill Hall, Fargo, ND 58105, evaluates on-farm economic feasibility of incorporating legumes in wheat production systems.

Wisconsin: Michael Fields Agricultural Institute: Steve Guldan, Research Agronomist, East Troy, WI, coordinates on-farm research/demonstrations and controlled experiments.

Kansas: John Havlin, Agronomy Department, Throckmorton Hall, Manhattan, KS 66506, co-investigates living mulches with controlled experiments in western Kansas; Alan Schlegel, Research Appointment in Soil Fertility and Management, Tribune Unit, Southwest Kansas Branch Experiment Station, Box 307, Tribune, KS 67879, co-investigates living mulches with controlled experiment in western Kansas.

University of Nebraska: Robert Klein, Extension appointment specializing in cropping systems, West Central Research and Extension Center, Route 4, Box 46A, North Platte, NE 69101. Investigator with controlled experiments in west-central Nebraska.

Farmer Participants:

David Podoll, Fullerton, ND; Kent Ableidinger, Kensal, ND; Charles Nelson, Ayr, ND; Don Dufner, Buxton, ND; Terry Jacobson, President, Northern Plains Sustainable Agriculture Society, Wales, ND; Dan Thomas, Karlsruhe, ND; Bob Neevel, Litchville, ND; Eugene Haakenson, Bismarck, ND; Dennis Montgomery, Carrington, ND; Carmen Fernholz, Madison, MN.

Overview

Wheat-fallow production systems have been used for nearly a century in the wheat producing Great Plains states of Kansas, Nebraska, North and South Dakota. In addition to moisture conservation, fallow is also practiced to mineralize nitrogen and control weeds. While stabilizing wheat yields on a bushel per acre basis, fallow leaves a sizeable acreage idle each year and contributes to wind and water erosion. In other wheat producing areas of the world, such

as southern Australia, cereal grain/legume companion crop production systems are utilized to keep the soil covered, fix atmospheric nitrogen, reduce weed competition, and provide improved grazing potential. These systems have been explored in the US Palouse and Northern Plains wheat production areas and have exhibited the potential to reduce agrichemical inputs, both conserve and improve the soil resource, and increase net return per acre.

The value of legumes in rotation and as companion crops is well documented in humid areas. Less is known and only limited success has been demonstrated in semi-arid conditions with traditional species, such as sweetclover and alfalfa. Alternative species which use less water, such as black medic (*Medicago lupulina L.*), seem feasible in the spring wheat region of central North and South Dakota.

To further identify the potential of legumes replacing fallow in the wheat production areas of the US Great Plains, a number of locations have been identified which represent a continuum of moisture stress, from the most humid (north and east) in North Dakota, to the most arid (south and west) in Kansas. In the most humid region, ten farmers are cooperating to test alternative legumes (primarily black medic and sweet clover) and alternative legume management systems in large, replicated plots. These sites are serving as a research and demonstration source for utilization by an on-farm research coordinator from the Michael Fields Agricultural Institute, state extension services, and the NPSAS. Small plot and feasibility research on black medic and other alternative legumes and production systems are being conducted on experiment stations by North Dakota State University at Carrington, University of Nebraska at North Platte, and by Kansas State University at Tribune.

Objectives

1. To demonstrate and conduct on-farm and experiment station research of a cereal/legume production system in the spring cereal region of the US Great Plains.

2. To use on-farm cost/return data, in combination with experiment station grazing and quality data, compare whole farm budgets for conventional versus alternative legume production systems.

3. To determine through small-plot research, the suitability of alternative legumes as companions in a cereal/legume production system in both spring and winter wheat regions.

4. To use the most promising legumes, develop management systems in combination with wheat, other locally adapted crops, and livestock to substitute for fallow in the spring and winter wheat regions of the Northern Great Plains.

Project Duration: Four years. Continuation of funding: June 1990 to September 1992
Funding: $341,000: $74,000 in 1988-89; $82,000 in 1990; $185,000 in 1991-92
Matching: $271,139

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

North Dakota State University, $97,500, ($116,188)
Michael Fields Agricultural Institute, Wisconsin, $110,500, ($3,000)
South Dakota State University, $1,000, (in-kind)
10 farmers, $18,000, ($33,440)
Kansas State University, $57,000, ($86,620)
University of Nebraska, $57,000, ($30,000)

LNC88-10.1: SUBSTITUTING LEGUMES FOR FALLOW IN UNITED STATES GREAT PLAINS WHEAT PRODUCTION

Major Participants:

NDSU Carrington Research Extension Center: John C. Gardner (Project Coordinator), Agronomy; Blaine Schatz, Agronomy; Vern Anderson, Animal Science

North Dakota State University: Dave Watt, Agricultural Economics

Michael Field Agricultural Institute: Steve Guldan, Research Agronomy

Kansas State University: John Havlin, Agronomy; Alan Schlegel, Soil Fertility and Management

University of Nebraska: Robert Klein, West Central Research Extension Center

Northern Plains Sustainable Agriculture Society (NPSAS): Terry Jacobsen, President

Nebraska Sustainable Agriculture Society (NSAS): Sam Welsch, Hartington, NE

Overview

Using a common set of legumes and management systems, plus any additional site-specific treatments desired, the small-plot feasibility research has quickly progressed in identifying the adaptation zones of both legume species and management practices. Black medic, for example, did not prove reliably winter-hardy enough for the northern-most locations, but has performed relatively well in Nebraska trials. Hairy vetch, though a competitive water user if not properly managed, seems best adapted in southwest Kansas and Nebraska, but has also shown promise in North Dakota.

Though neither farmer use nor historic research on legume-fallow is as common in this region, sufficient data and interest now exist to expand on-farm research and demonstration southward into Nebraska. The Nebraska Sustainable Agriculture Society was added to help coordinate these efforts in conjunction with the on-going research at the University of Nebraska West Central Research Extension Center.

This continuation provides for an expansion of on-farm research sites in the northern area, evaluation of methods used for establishing legumes in row crops, and in the expansion in Nebraska from testing results on a small plot research to field-size testing. The Nebraska on-farm effort will also include a considerable effort in developing cropping systems which include wheat and interseeded row crops. And, small-plot work will continue in North Dakota, Nebraska, and Kansas in a continuing effort to gain experience and data to compare alternative legumes and legume management systems. Specifically, these trials will add to the growing body of knowledge that farmers need in order to choose both a legume and a rotation that will complement their cash grain and/or livestock operation. This coordinated effort of land-grant universities, non-profit organizations, and farmers is needed to effectively substitute legumes for fallow across the U.S. Great Plains.

Objectives

The overall objective is to discover if legumes exist which could be incorporated successfully, and developed into, cash grain-legume production systems for the U.S. Great Plains.

1. Through small-plot research, to continue exploring the suitability of alternative legumes as a key feature in developing new crop and livestock management systems which will successfully substitute for fallow in the spring and winter wheat regions of the U.S. Great Plains.

2. To research and demonstrate the on-farm suitability of legumes and crop-legume systems which best performed at the small-plot scale and in innovative farmers' fields in the spring wheat region of North Dakota and the winter wheat area of Nebraska.

3. Using cost/return data generated in legume and system comparison studies, compare both wheat enterprise and whole-farm budgets for conventional fallow versus alternative legume production systems.

Project Duration: Two years, ending Aug. 31, 1994

The following groups received funds and provided matching funds:

North Dakota State University, Carrington Research and Extension Center;
North Dakota State University Agricultural Economics;
Nebraska Sustainable Agriculture Society;
Northern Plains Sustainable Agriculture Society;
Michael Fields Institute;
Kansas State University; and
University of Nebraska.

LNC88-11: THE MIDDLE BORDER ON-FARM RESEARCH CONSORTIUM

(Revised 5/2/91)

Major Participants:

Land Stewardship Project: Patrick J. Moore (Project Coordinator), 14758 Ostlund Trail North, Marine On Saint Croix, MN 55047, Phone: (612) 433-2770. Audrey Arner, Director, LSP Western Minnesota Program, 109 W. Nichols, Montevideo, MN 56256.

Kansas Rural Center: Jerry Jost, Coordinator, Sustainable Farming Project, 304 Pratt Street, Whiting, KS 66552

University of Nebraska: Charles Francis, Agronomist, Extension Crops Specialist, Lincoln, NE 68506.

Nebraska Sustainable Agriculture Society: Sam Welsch, Director, P.O. Box 736, Hartington, NE 68739.

Cooperators:

Organizations: Middle Border On-Farm Research Consortium; Minnesota Department of Agriculture; Rodale Institute; Sustainable Farming Association of Western Minnesota, Box 367, Montevideo, MN 56265.

Farmer Participants:

Larry Olson, Rte. 1, Granite Falls, MN 56241; Edward Reznicek, Rte. 2, Goff, KS 66428.

Overview

The key participants in this project are more than 100 farmers in Kansas and Minnesota, working closely with members of private organizations and universities. The project is coordinated by Patrick Moore of the Land Stewardship Project in Minnesota. The Middle Border On-Farm Research Consortium includes team members from the Kansas Rural Development Center, the Nebraska Sustainable Agriculture Society and the University of Nebraska. The Middle Border area is defined as southwest Minnesota, eastern South Dakota, Nebraska, and northeast Kansas.

The distinguishing feature of this project is that the Consortium relies primarily on grass-roots input from local farmer networks to determine what research is to be done and how to carry it out. These emerging networks provide important social support to farmers attempting to make the transition from heavy dependence on synthetic chemical pesticides and other purchased inputs to low-input farming systems. The farmer networks also serve as focal points for technology transfer in disseminating scientific findings from experiment stations and other institutional research to farmers. The Consortium is bridging the gaps between farmers, researchers and private non-profit organizations in order to foster the widespread adoption of ecologically sound, profitable, and sustainable farming practices throughout the Middle Border region.

The Consortium's farmer networks conduct on-farm research and demonstrations on a wide variety of economically and environmentally sound farming practices such as the following:

- Assessing the farmer usability of an on-farm soil nitrate testing kit;
- Research and demonstration comparing the capabilities of raw manure, compost, and legumes to build and maintain soil fertility;
- Use of the rotary hoe rather than herbicides for control of weeds in row crop production;
- Overseeding of legumes as a winter cover crop and a spring plowdown of the green manure;
- Use of moisture-conserving legumes in crop rotations and as interseeded crops with small grains.

Objectives

1. Disseminate information on LISA farming techniques to the farmers of the Middle Border through workshops and farm tours.

2. Develop more self-sufficient farmer-to-farmer, on-farm research networks to conduct research and promote the widespread adoption of LISA practices.

3. Refine the documentation and methodology for participatory on-farm research.

4. Integrate information generated from the Consortium's participatory on-farm research experience into mainstream publications, and University/Extension information dissemination channels.

5. Publish books, reports, and videotapes on low-input sustainable practices for distribution to the farmers of the Middle Border.

Results

The network provided support for a variety of on-farm research and demonstration projects to explore alternative technologies and/or management practices. These projects offered farmers encouragement and financial assistance to investigate farming practices which support the viability of family farms and reduced the potential for groundwater contamination and soil erosion. In recognizing the complexity of operating farms, these demonstration projects require that farmers think through their current farming operation and, at a low risk, try alternatives that appear to fit their needs. Observations are important because, in the complex interactions of nature and agriculture, it is not always possible to measure what is observed in BTU's or dollars. The goal of this on-farm problem-solving is to encourage farmers to explore alternatives within their own farming operations. Field tours, workshops and meetings were held to help farmers communicate their results.

Project Duration: Three years

Funding: $296,277: $75,000 in 1988; $107,697 in 1989; $113,580 in 1990
Matching: $338,395

The following groups received funds and provided matching funds (as indicated by the figures in parantheses):

Land Stewardship Project, $123,780, ($155,500)
Kansas Rural Development Center, $105,497, ($94,295)
University of Nebraska, $11,000, ($3,000)
Nebraska Sustainable Agriculture Society $56,000, ($86,100)

LNC88-12: WHOLE-FARM ECONOMIC ANALYSIS OF MEDIUM-SIZED, SINGLE-FAMILY DAIRY FARMS THAT DIFFER IN THEIR USE OF PURCHASED CHEMICAL INPUTS

(Revised 3/12/91)

Major Participants:

Wisconsin Rural Development Center (WRDC): Jess Ennis (Project Coordinator), 1406 Bus. Highway 18/151 East, Mount Horeb, WI 53572, Phone: (608) 437-5971. Agricultural Economics, project design; economic model design; economic data collection; economic analysis; interpretation of results to project farmers; press work; developing slide show; presentations to groups; farmer meetings and field days.

Sustainable Agriculture Program: Margaret Krome, project design; adviser. Sustainable Agriculture Demonstration Project: Ken Rineer, adviser.

University of Wisconsin, Madison 53706: Richard M. Klemme, Agricultural Economics, Center for Integrated Agricultural Systems, project design; economic model design; economic analysis; presentations to groups. Bimal RalBhandary, Environmental Studies/Agricultural Economics, economic model design; computer data work. Advisers: Larry Bundy, Soil Science; Cathy Pulvermacher, Dairy Farmer.

University of Wisconsin, River Falls 54022: Stan Schraufnagel, Agricultural Economics, economic analysis.

Wisconsin Department of Agriculture, Trade and Consumer Protection, P.O. Box 8911, Madison, WI 53708

Farmer Participants:

Forty-five Wisconsin dairy-farm families annually provide detailed economic information about their farms and practices; improve the research design; attend meetings; attend and host farm field days.

Overview

Thirty-five Wisconsin farms were selected, 32 of which were dairy operations, to take part in an economic comparison of low-chemical vs. conventional farming techniques. The farms were scattered over a six-county region. About half of these are farms where little or no synthetic chemical pesticides or fertilizers were being used. The other half used conventional practices. Farmers were asked to compile information on their production methods. Project coordinators, led by Margaret Krome of the Wisconsin Rural Development Center, visited 30 of the farms to help farmers complete the survey. In 1990, 13 new farmers were added to the project to provide 1991 data.

Farmers have taken part in meetings and discussion sessions. Six farmers have given public field tours. One of the participating conventional farmers has decided to make a transition to low-chemical farm management because of what he observed during these field tours.

Project scientists gave each of the farmers a detailed economic analysis of their farm. Farmers who switched from conventional methods, using baled and chopped hay, to rotational grazing realized an average of 68% savings in annual costs per acre. For the group as a whole, however, there was no significant difference between the net returns of farms managed with little or no chemicals versus those managed conventionally. Long-term impacts on the farm's productivity and profits, as well as the reduction in environmental risks are not yet known. However, certain farmers who have changed from conventional management of their farms have reported seeing important improvements in their soils, which they characterized as "healthier soils, better tilth, less compaction, greater water absorption and a greater abundance of earthworms." Farmers also report their livestock appeared healthier following the transition. Further study is needed to substantiate these observations.

Objectives

1. Accumulate, on an annual basis, detailed economic data concerning each of the 45 farms.

2. Conduct a comparative economic analysis of the farms, grouped according to their use of pesticides and commercial nitrogen fertilizers.

3. Generate whole-farm economic analyses of each farm.

4. Promote the exchange of information and ideas among farmers, and between farmers, researchers and agricultural agencies.

Results

The project's farmers record information about their cropping and livestock practices, input costs, and production, as well as detailed inventories of their machinery and equipment. All of the farmers' costs -- both paid and opportunity costs (e.g. labor, fuel, purchased crop and livestock inputs, equipment, land) -- and the value of production are determined for each crop, for the livestock, and on a whole-farm basis. In this way net returns to the farm and to the various crop and livestock enterprises on the farm can be calculated to make economic comparisons of different practices.

The project also functions as a medium for farmers to exchange information about their practices. At meetings, farm field days and workshops, project farmers and other farmers trade information and ideas about their farming techniques and philosophies. Researchers, extension agents, and other agriculturalists also take part and learn about innovative practices and about farmers' concerns.

As a result, some farmers in the project have, in fact, adopted chemical-reducing techniques they've learned from other farmers. Farmers have thus proven to be a vast source of knowledge about innovative chemical-reducing, cost-cutting methods, and they are able to benefit from the trial and error others have undertaken.

Profitability Analysis

The first round of economic analysis of the original 27 farms (there are now 45) has shown that cutting applications of pesticides and commercial sources of nitrogen likely has economic benefits. The first findings suggest that medium-sized dairy farms in areas similar to southwestern Wisconsin can use low-or no-purchased-chemical systems and be at least as profitable as similar conventional farms.

In terms of whole-cropping systems (i.e., all of the crops raised on the farm), the Low-Chemical group fared the best, averaging $153 of net return per acre; the No-Chemical group was next, averaging a net return or $136 per acre; the Routine-Chemical group followed, with an average net return of $121 per acre.

Each group's costs for pesticides and commercial fertilizer were as follows: The Low-Chemical group spent an average of $104 for pesticides and $1,858 for commercial fertilizer; the No-Chemical group had no pesticide costs and spent an average of $637 for fertilizers; the Routine-Chemical group spent, on the average, $1038 for pesticides and $4,389 for commercial fertilizers. Each group averaged about 150 cropping acres.

This project has so far suggested that reducing the use of purchased farm chemicals on a medium-sized dairy farm presents significant potential for improving farm profits.

LNC88-12.1: WHOLE-FARM ECONOMIC ANALYSIS OF MEDIUM-SIZED, SINGLE-FAMILY DAIRY FARMS THAT DIFFER IN THEIR USE OF PURCHASED CHEMICAL INPUTS

Major Participants:

Wisconsin Rural Development Center: Jess Ennis (Project Coordinator), Agricultural Economics, 1406 Business Highway 18-151 East, Mt. Horeb, WI 53572, Phone: (608) 437-5971. Margaret Krome, Sustainable Agriculture Program.

University of Wisconsin, Madison: Richard Klemme, Agricultural Economics, Center for Integrated Agricultural Systems, Madison, WI 53706; Bimal RajBhandary, Environmental Studies, Agricultural Economics; Larry Bundy, Soil Science; Cathy Pulvermacher, Dairy Farmer, Adviser.

University of Wisconsin, River Falls: Stan Schraufnagel, Agricultural Economics, River Falls, WI 54022.

Wisconsin Department of Agriculture, Trade and Consumer Protection: Ken Rineer, Sustainable Agriculture Demonstration Project, P.O. Box 8911, Madison, WI 53708.

Farmer Participants:

Fifty-one Wisconsin dairy-farm families: Darrel and Yvonne Aden, Blue River; Ted Bay, Steuben; Richard Benson, Platteville; Dennis Biba, Muscoda; Sylvester and Sue Breuer, Glen Haven; John and Mary Brown, Dodgeville; Lawrence Caley, Bloomington; Mike and Charlotte Cannell, Cazenovia; Merlin and Kay Dosch, Viola; David and Marta Engel, Soldiers Grove; Pete and Judy Edstrom, Ridgeland; John and Kathy Endres, Sauk City; David and Dianna Esterby, Bay City; Ed and Paula Fiedler, Prescott; Eugene and Mary Fritsche, Steuben; Vince and Barbara Garvoille, Spring Green; Gerald Gilbertson, Avoca; Ken and Carla Greiber, Spring Valley; LaVern and Betty Hardyman, Darlington; Ronald and Joan Heebink, Baldwin; Jim and Jane Heisner, Mineral Point; Raymond and Sherri Ihm, Lancaster; Francis Ihm, Cassville; Tim and Sandy Jackson, Knapp; Lloyd Johnson, Osceola; Don Kellesvig, Mt. Horeb; Walter and Doris Kmieciak, Stanley; Mike Kozlowski, Reedsburg; Norbert Krusiec, Mineral Point; Tom and Judy Lauffer, Dodgeville; Doug Liebfried, Platteville; Fritz Mani, Mt. Horeb; Alan and Kathleen Martinson, Barron; Bud Mecusker, Menononie; Harold and Sandy Morrison, Darlington; Tim and Sue Olson, Soldiers Grove; Gerald and Debbie Nelson, Arena; Dan and Jean Patenaude, Highland; Carl and Cathy Pulvermacher, Lone Rock; Jay Richard, Kieler; Curt and LaMae Rohland, Withee; Ric and Theresa Scullion, Highland; Gary and Marlis Seipel, Eau Galle; Oscar Stenjem, Cambridge; Irv and Mickey Snyder, Spring Green; Karl Stieglitz, Greenwood; Arlen and Laurie Strate, Roberts; Robert Swenson, River Falls; David Wiederholt, Cuba City; Peter and Hilary Wood, Blanchardville; Harvey and Linda Zabel, Prairie du Chien.

Overview

Farmers who routinely use pesticides and inorganic fertilizers face uncertainty and economic risk if they consider substituting non-chemical techniques for their chemical methods of combating pests and providing soil fertility. For environmental, health and economic reasons many farmers are clearly growing more interested in alternative, non-chemical methods, but they face a lack of information about those methods, especially regarding their economic impacts on farms.

This cooperative, interagency research study analyzed economic impacts of various levels of agricultural chemical use on operating farms. This project was continued so that the relative economic merits of routine-chemical, low-chemical, and no-chemical farming, could continued to be documented on the 48 medium-sized dairy farms. Monitoring these farms and building a data base for two additional years provides more reliable conclusions about the economics of those methods. The relative economic performances of the farms will continue to be evaluated on a whole-farm and an enterprise-by-enterprise basis.

The continuation also includes provisions for field days, meetings, and workshops so participating farmers can exchange ideas and information about cost-cutting, chemical-reducing techniques and communicate their findings to educators and the general public.

Objectives

1. Continue to accumulate detailed economic data on the 48 participating farms.

2. Conduct a comparative economic analysis of the 48 participating farms, grouped according to their use of pesticides and purchased nitrogen fertilizers.

3. Generate annual whole-farm economic analyses of each individual farm.

4. Facilitate the exchange of information and ideas among farmers and between farmers, researchers and agricultural agencies.

Project Duration: Four years
Funding: $155,500: $25,000 in 1988-89; $62,000 in 1989-90; $68,500 in 1991-92
Matching: $155,580

The following groups received funds and provided matcing funds (as indicated by the figures in parentheses):

Wisconsin Rural Development Center, $139,250, ($18,350)
University of Wisconsin, Madison, $12,750, ($51,655)
University of Wisconsin, River Falls, $3,500, ($14,050)
Wisconsin Department of Agriculture, Trade and Consumer Protection, ($57,025); CALS ($14,500)

LNC88-13: EVALUATION OF INTEGRATED LOW-INPUT CROP-LIVESTOCK PRODUCTION SYSTEMS

(Revised 3/5/91)

Major Participants:

North Dakota State University (NDSU) Carrington Research Extension Center: J.C. Gardner (Project Coordinator), P.O. Box 219, Carrington, ND 58421, Phone: (701) 652-2951. B.G. Schatz, Plant Science; V.L. Anderson, Animal Science, Box 219, Carrington, ND 58421.

NDSU Fargo Research Extension Center: S. Boyles, Animal Science; D. Watt, Ag. Economics; H. Meyer, Entomology.

NDSU Hettinger Research Extension Center: T. Faller, Animal Science, Box 507, Hettinger, ND 58639.

University of Missouri: R.A. Weinzieri, Entomology, 1-87 Ag Bldg, Columbia, MO 65211.

University of Illinois: R.D. Hall, Entomology, 607 E. Peabody, Champaign, IL 61820.

Overview

Diversifying the biology and the economy of Northern Plains agriculture could be done by discovering new ways of integrating and re-introducing livestock into the agroecosystem. While including ruminant animals in the production system may not be essential for the development of a more sustainable agriculture, several factors suggest that integrated crop-livestock production systems would be beneficial. Cereal grain straws are abundant in the Northern Plains farming areas and legume hay crops often are included in low-input cropping systems for nitrogen fixation and conservation. Legume hay, screenings and weather damaged grain crops complement crop residues in ruminant diets. Integrated enterprises not only maximize use and value of crop products as livestock feed, but also ensure employment throughout the year. Economic viability, however, is necessary to continue operation regardless of production methods. Adding livestock to a crop farm will require additional management of manure and control of insects, particularly flies that feed on livestock and reproduce in manure. Increasing horn fly resistance to insecticides, EPA bans, and consumer concerns suggest a need for study of non-chemical approaches for fly control.

Objectives

1. Determine the carrying capacity, animal performance and unique management needs of beef cows and sheep supported by low-input crop production systems.

2. Compare economic returns of low-input farms from crops versus crops-livestock production systems.

3. Quantify nitrogen and carbon movement, and effects, from removing crop products and returning manure to low-input cropping systems.

4. Evaluate the relative effectiveness and economics of mechanical fly control versus conventional chemical fly control for beef cows.

Project Duration: Three years
Funding: $132,700: $50,000 in 1988-89; $82,700 in 1989-90
Matching: $93,000 + In Kind.

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

North Dakota State University, $115,870, ($58,103)
University of Missouri, $5,450, ($15,897)
University of Illinois, $5,880, ($15,000)
Farmers, $5,500, ($4,000)

LNC88-14: BEGINNING FARMER SUSTAINABLE AGRICULTURE PROJECT

Major Participants:

Center for Rural Affairs: Ron Krupicka (Project Coordinator), P.O. Box 405, Walthill, NE 68067, Phone: (402) 254-6893. Larry Krcil, Range Science.

Nebraska Sustainable Agriculture Society: Sam Welsch, Director.

University of Nebraska: Chris Carlson, County Extension Agent, Battle Creek, NE; Dann Husmann, Agricultural Education.

Overview

Beginning farmers and livestock are both important components to the success of sustainable agriculture practices. The current trend in livestock production has been to use capital intensive confinement related technologies to concentrate large numbers on large farms while ignoring low-cost sustainable livestock technologies that are appropriate for beginning farmers.

The Center for Rural Affairs has expanded its 14-year history of working with farm families in developing sustainable agricultural practices to coordinating activities with other sustainable agriculture organizations in the North Central Region. In addition the Center has developed good working relationships with a wide variety of farm organizations and educational institutions. The objective of this project is to develop instructional material on sustainable crop and livestock production practices that will help young and beginning farmers enter farming. These materials are being developed in collaboration with cooperating groups and organizations but more importantly with the active participation of young and beginning farmers.

Specific proposed activities include selecting a cooperating group of 25 beginning farmers who will attend workshops and participate in developing sustainable whole farm strategies to enter farming. These strategies will include sustainability as a goal to be pursued by using more sustainable farming practices. A flexible curriculum will be developed that will consist of videotapes, case studies, and fact sheets that will be made available to young and beginning farmer organizations, sustainable agriculture organizations, vocational agriculture programs and the Cooperative Extension Service in the North Central Region.

1991 Continuation

LNC88-14.1: BEGINNING FARMER SUSTAINABLE AGRICULTURE PROJECT

Major Participants:

Center for Rural Affairs: Larry Krcil (Project Coordinator), Sustainable Agriculture Practices Team Leader, P.O. Box 736, Hartington, NE 68739, Phone: (402) 254-6893. Shawn Gralla, Program Associate; Chuck Hassebrook, Leader of the Stewardship, Technology and World Agriculture Program.

Center for Holistic Resource Management: Roland Kroos, Education and Project Director.

Nebraska Sustainable Agriculture Society (NSAS): Sam Welsch, Executive Director.

University of Nebraska: Glenn Helmers, Agricultural Economics Department.

Farmer Participants:

Terry Dendinger, Farmer and President of the Hartington FFA Alumni; Pat and Julie Steffen, Beginning Farm Family, Fordyce, NE.

Through the continuation of this project beginning farm families were organized into mutual-help networks in northeast Nebraska. A special advisory committee of beginning farm families helped shape the project. Specific support network activities will include short courses, informational workshops, construction workshops, farm tours, on-farm research and on-farm consultation with farm families. The project prepared descriptive case studies of participating farm families who agreed to keep whole-farm records including finances, energy and chemical use and other environmental measures. A professional advisory committee assisted in developing evaluation criteria, procedures and data needs to provide objective measures of progress in establishing economically viable and environmentally sound farms.

Objectives

1. Organize mutual-help groups of beginning farmers. Group learning techniques will be used to advance the use of more sustainable farming methods among beginning farmers and assist them in establishing economically viable farming operations.

2. Support beginning farm families in practicing holistic farm management and using sustainable agriculture strategies for entering agriculture.

3. Evaluate progress of cooperating farm families toward developing economically viable and environmentally sustainable farms and evaluate this project as a potential model for use by the Extension Service, private organizations and other institutions.

Project Duration: Five years
Funding: $164,696: $16,848 in 1988-89; $26,280 in 1989-90; $29,868 in 1990-91; $91,700 in 91-93
Matching: $134,563

LNC88-15: AN INTEGRATED RESEARCH/EXTENSION PROGRAM IN LOW-INPUT CROP PRODUCTION FOR OHIO

Major Participants:

Ohio State University: Donald J. Eckert (Project Coordinator), Soil Fertility, Dept. of Agronomy, 2021 Coffey Rd., Columbus, OH 43210, Phone: (614) 292-6446. Rattan Lal, Soil Physics.

Overview

This project lays the foundation for continuing research and educational programs in low-input agriculture in Ohio. The project will maintain a set of successfully established research/demonstration plots located in two major land resource areas in Ohio, allowing for the evaluation of the interactive effects of differing crop rotation sequences and levels of input on crop productivity, soil and ecosystem characteristics, and profitability. Rotations include corn-soybean and corn-soybean-wheat-legume, with each crop in each rotation appearing each year. Treatments (with three replications) include no chemical inputs, chemical inputs at recommended levels, and substitution of manure for fertilizer. Plot experiments will also allow continued monitoring of the evolution of different systems, providing a basis for recommendations dealing with low-input systems at different stages of development.

Objectives

1. Establish a duplicate set of replicated plots at two locations in Ohio to compare two crop rotations under several levels of external input and provide continuing sites for developing less-chemical-intensive crop production systems.

2. Investigate changes in crop performance, biological activity and soil characteristics associated with low-input production strategies on different soil types.

3. Disseminate best available information on low-input systems to farmers of Ohio through field days, a reference bulletin, and other Extension activities.

Project Duration: Two years
Funding: $78,000: $38,000 in 1988; $40,000 in 1989.
Matching: $53,500

LNC88-16: ASSESSING SOIL PHOSPHORUS AVAILABILITY IN LOW-INPUT SYSTEMS

Major Participants:

Kansas State University: Steve J. Thien (Project Coordinator), Soil Biochemistry, Dept. of Agronomy, Throckmorton Hall, Manhattan, KS 66506, Phone: (913) 532-6011. A. Paul Schwab, Soil Chemistry; Roger Myers, graduate student.

Overview

Low-input and sustainable systems require reliable knowledge of a soil's phosphorus supplying ability for effective management of phosphorus nutrition. For soils that do not regularly receive phosphorus from fertilizer, current soil tests do not reliably predict phosphorus availability. Plants tend to rely on organic soil phosphorus in low-input systems. When inputs of inorganic phosphorus are reduced, the readily available soluble pools of orthophosphate will decline and crops will depend more on the mineralization of organic phosphorus to provide

adequate nutrition. Under these circumstances, a test which evaluates only the inorganic status of the soil will likely be inadequate to describe the phosphorus supplying power of a soil.

Through this project researchers will develop a soil test which will account for both the inorganic and organic fractions of phosphorus in the soil which are available for plant uptake during the growing season. A successful soil test needs to emulate the plant uptake process either by 1) quantifying the labile organic phases or 2) measuring the rate of mineralization.

Objectives

1. Develop a soil test capable of predicting the P-supplying power of a soil in a low-input system.

2. Evaluate this new soil test on a wide variety of soil types, for its ability to predict which soils will respond to fertilizer inputs.

Project Duration: Two years
Funding: $38,691: $18,949 in 1988; $19,742 in 1989
Matching: $40,619

LNC88-17: EFFECT OF TILLAGE AND WEED CONTROL ALTERNATIVES ON CROP ROTATIONS

Major Participants:

Iowa State University: Richard M. Cruse (Project Coordinator), Soil Mgt. Research, 3212 Agronomy, Ames, IA 50011, Phone: (515) 294-4111. James L. Baker, Water Quality Research, Agricultural Engineer; Michael D. Owen, Extension Weed Control Specialist.

USDA/Agricultural Research Service: Donald C. Erbach, Tillage and Machinery Design Research, 219 Davidson Hall, Iowa State University, Ames, IA 50011.

Farmer Participants:

Practical Farmers of Iowa: Richard Thompson, Farmer, President, Route 2, Box 132, Boone, IA 50036.

Overview

The information base required to integrate conservation tillage and legume-base crop rotations into effective and efficient low-input farming systems is woefully small. Conservation tillage is not a new technology. Neither is the use of crop rotations for soil, water, and energy conservation and enhanced crop production. However, combining conservation tillage and crop rotations, while reducing inputs, is a new goal for the farm community. The challenge facing researchers and farmers is to successfully integrate conservation tillage practices and more diverse crop rotations with reduced chemical inputs.

Objectives

1. Determine the degree of weed control success obtained using different weed control strategies for a corn-soybean-oats/alfalfa rotation managed with three different tillage systems.

2. Determine the effect of tillage systems on crop yields and legume nitrogen production in a corn-soybean-oats/alfalfa rotation.

3. Determine the potential for small grain production with ridge tillage.

4. Evaluate the effect of nitrogen incorporation in the ridge and herbicide banding with ridge tillage on surface and subsurface drainage losses of nitrate and herbicides.

Project Duration: Two years
Funding: $80, 000: $40,000 in 1988; $40,000 in 1989
Matching: $80,465

LNC88-18: MAKING THE CONVERSION FROM CONVENTIONAL TO SUSTAINABLE AGRICULTURE: A VIDEOTAPE SERIES FOR FARMERS

Major Participants:

Iowa State University: Jerald R. DeWitt (Project Coordinator), Assoc. Director, IPM Coordinator, Iowa State University of Science and Technology, Ames, IA 50011, Phone: (515) 294-4111. Garren O. Benson, Extension Agronomist/Crop Production; Roger H. Brown, Extension Video Production Specialist.

Overview

Farmers in the Midwest are currently faced with two types of problems: (1) environmental hazards to the family and natural resources and (2) lingering financial difficulties. Farmers must learn to use crop and livestock systems and agricultural inputs that maintain economic and social viability while preserving the high productivity and quality of natural resources. To make the conversion from conventional to sustainable agriculture, farmers need practical information about technical aspects of the conversion process (i.e., plant nutrient needs, cover crops, insect management, weed management, tillage, rotations, livestock, forages, economics, and others).

Objectives

1. Form a multi-state coordinating committee.

2. Develop three broadcast-quality videotapes, 25 to 28 minutes each.

3. Deliver the videotapes to farmers in the Midwest and nationally.

Project Duration: One year.

Funding: $50,000: $20,000 in 1988; $30,000 in 1989
Matching: $55,171

LNC88-19: LOW-INPUT BEEF CATTLE SYSTEMS OF PRODUCTION

(Final report)

Major Participants:

University of Nebraska: Terry Klopfenstein (Project Coordinator), C220 Animal Science, Lincoln, NE 68583-0908, Phone: (402) 472-6443. Jim Gosey, Beef Extension; Rick Rasby, Beef Extension; Bruce Anderson, Forage Extension & Research; Rick Stock, Beef Research & Extension; George Pfeiffer, Ag. Econ. Research & Extension.

University of Missouri: John Paterson, Beef Nutrition Research, S111 Animal Science Center, Columbia, MO 65211; Jack Whittier, Beef Extension & Research; Monty Kerley, Beef Research; Jim Forwood, Forage Research.

Iowa State University: Jim Russell, Beef Nutrition Research, Dept. of Animal Science, Ames, IA 50011; Allen Trenkle, Beef Research; Daniel Loy, Beef Extension; Daryl Stobehn, Beef Extension; Walter Wedin, Agronomy Research; Stephen Barnhart, Agronomy Extension; J. Arne Hallam, Ag. Econ. Research.

Overview

The areas of southern Iowa, northern Missouri and eastern Nebraska are similar in erodibility of the soils, the mix of row crops and pastures on most farms and the production of beef as cow/calf or yearlings. Because of their unique ability to utilize forages, beef cattle fit into such a farming system. Beef producers can become more competitive by increasing the economical use of forages and by reducing input costs. Dramatic savings could be realized without greatly reduced output by:

- Maximizing use of forage;
- Minimizing use of grains;
- Maximizing grazing;
- Minimizing harvesting; and
- Minimizing purchased supplemental feed.

Results

Year-round beef production systems were tested in Nebraska, Iowa and Missouri. Research at the University of Nebraska has shown that grain feeding can be cut in half by using an extensive, low-input, high-forage system of grazing and finishing cattle. The grain needed per pound of gain was reduced from 5.3 to 2.4 lb. Better yet, the cost of weight gain was $.06/lb lower on the forage system.

The "summer slump" due to poor growth when cattle are grazing endophyte-infested tall fescue, was solved by investigators at the University of Missouri by grazing sorghum sudan, warm-season grass or endophyte-free fescue. By interseeding sorghum sudan into endophyte-infected tall fescue sod, the reappearance of tall fescue in the fall was minimal. This grazing system provides the producer with an opportunity to kill an infected stand without sacrificing the opportunity to graze animals on these pastures during the summer. The renovated pastures can then be seeded to an endophyte-free variety of tall fescue.

In studies conducted at Iowa State University, rotational grazing of an alfalfa-grass pasture resulted in greater total calf production while not affecting the growth of individual calves. It also led to an increase in the percentage of legume in a pasture, possibly due to reduced competition with grasses and the rest periods for the legumes which occur in rotational grazing. Cow gains on corn stalks were related to stocking rate and gains were improved by strip grazing. In general, better management gave better cattle performance and greater returns.

The results from this research were presented at a national symposium in April 1990, co-sponsored by LISA and the National Academy of Sciences, and at a three-state symposium in June 1990.

Project Duration: Two years
Funding: $152,500: $76,500 in 1988; $76,000 in 1989
Matching: $270,011

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Nebraska, $50,833, ($83,649);
University of Missouri, $50,834, ($85,892); and
Iowa State University, $50,833, ($59,830).

LNC88-20: PERFORMANCE AND ECONOMICS OF A LOW-INPUT FEEDER SWINE OPERATION

(Revised 3/12/91)

Major Participants:

University of Minnesota: Carlos Pijoan (Project Coordinator), College of Veterinary Medicine, 385 Animal Science and Veterinary Medicine Building, 1988 Fitch Avenue, St. Paul, MN 55108, Phone: (612) 625-5000. L. Jacobson, Ag Engineering, Extension, facilities consultant; J. Pettigrew, Animal Science, Nutrition, nutrition consultant; Vernon Eidman, Agricultural Economics, economy analyst; P. Arellano, Veterinary Medicine, liaison.

Farmer Participants:

A. Olson, Swine Producer, Nerstrand, MN.

Overview

The project involves the construction and study of an alternative swine housing unit. The project compared 20 sows in the alternative environment to 20 sows in a conventional confinement system. Pigs were of identical genetics and age. The same farmer managed both systems. The two systems were compared in terms of biological and economical performance.

The alternative system consisted of three pens located in an uninsulated, naturally ventilated pole barn. Two pens were used to house gestating sows, while the third pen was used to house farrowing-lactating sows and weaned pigs.

Each pen had a super-insulated waterer that required no energy. Gestating sows were fed on a "skip-a-day" system, while lactating sows were fed ad libitum. A one-foot deep bed of straw provided insulation for the piglets and allowed sows to exercise nesting behavior. One week before the farrowing dates, farrowing cubicles (made out of plywood sheets) were placed to avoid excessive cross-fostering and prevent piglet-crushing. The cubicles were removed when the piglets were one week old. Piglets were weaned at four to six weeks of age and either stayed in this pen until they were seven weeks old or were moved to another pen.

This alternative system minimizes the major inputs used in confined units: capital expenditures, energy utilization and drug usage were reduced, and no feed antibiotics were used. Finally, animal welfare is enhanced through the use of open areas, and straw, with no crates.

Objectives

1. To evaluate behavior and biological performance of pigs housed in an alternative, low-input system compared to a fully confined system.

2. To perform a complete economic analysis of the two systems under study.

Results

- Sows in the confinement group weaned on average 9.1 pigs, whereas, sows in the alternative group weaned on average 6.9 pigs. Differences between the groups in the mean number of pigs weaned were expected, due to higher pre-weaning mortality in the alternative system. However, when data was analyzed by parity, third-parity sows in the alternative group attained outstanding results (9.9 pigs weaned per sow farrowed), pointing out that alternative systems, under favorable weather conditions, may obtain excellent results.

- The total number of pigs produced by the alternative and confinement groups were 301 and 341, respectively. This represents a 12% difference in favor of the conventional system.

- Sows in the alternative group remained in much better physical condition than sows in the confinement group. This difference was reflected in the number of sows culled, which was six times higher in the confinement group.

Economic Analysis

- The capital investment was 30% higher for the conventional system than for the alternative system.

- Fifty percent of the capital investment of the alternative system was the cost of labor performed by the farmer and her family.

- The monthly operating expenses for the alternative and conventional systems during the first six months were $666 and $831, respectively. Energy expenditures may account for the difference observed.

- The amount of labor required for the alternative system was 10% higher than in the conventional system. Some activities in the alternative system required the presence of several people, such as pig processing.

- An increase in feed consumption by sows in the alternative system was observed during the winter months. This could be explained by an increase in energy required by the sows to compensate for the weather conditions.

Project Duration: Two years
Funding: $63,800: $42,100 in 1988; $21,700 in 1989
Matching: $124,229

LNC88-21: UTILIZATION OF THE ALLELOPATHIC PROPERTIES OF WINTER RYE AS A METHOD OF WEED CONTROL IN SOYBEAN PRODUCTION

(Revised 3/26/91)

Major Participants:

Rodale Institute: James Tjepkema (Project Coordinator), Midwest Coordinator of On-Farm Research, Box 128, Clarksgrove, MN 56016, Phone: (507) 256-7409.

University of Wisconsin: Jerry Doll, Extension Weed Specialist, Agronomy Dept., Madison, WI 53706, supervises and coordinates the University of Wisconsin part of the project; Tom Bauer, graduate student, Agronomy, conducts the University of Wisconsin trials; analyzes and writes up the results.

Farmer Participants:

Richard Thompson, Rt. 2, Box 132, Boone, IA 50036; Robert Fogg, 3043 Olds Rd., Leslie, MI 49251; Ron Harmon, Rt. 2, Box 115, Salisbury, MO 65281; Terry Holsapple, Rt. 1, Box 289, Greenup, IL 62428; Richard Bennett, 7-740, P3, Rt. 5, Napoleon, OH 43545; Rudy Bauer, Rt. 1, Box 301, Brownsville, WI 53006; Gary Zicafoose, Rt. 2, Mead, NE 68041.

Overview

American farmers and weed scientists continue to seek improved strategies to manage weeds. Among the weed management options being investigated is the use of "natural herbicides" in rye to suppress weeds. This effect -- technically known as "allelopathy" -- is receiving renewed attention as a novel approach to weed management. A two-year field study was initiated in 1989 by scientists with the Rodale Institute (James Tjepkema) and the University of Wisconsin (Jerry Doll and Tom Bauer). Three experiments were done at the University of Wisconsin's Arlington Research Farm, and at seven on-farm sites throughout the Midwest. The purpose of this project was to determine the effectiveness of a cover crop (winter rye) to control weeds in soybean production. Various methods of managing the rye cover crop were examined. A major challenge is to terminate the rye cover crop in a way that will retain its allelopathic weed control power, while avoiding a regrowth or "retillering" of the rye that could tower over the soybeans, greatly reducing their yield.

Objectives

1. Conduct a series of trials (seven on commercial-scale farms and three replicated trials on a university research farm) testing the use of the allelopathic properties of rye as a weed control method for soybeans under different management and climatic conditions.

2. Study and assess other properties of the rye cover crop which may benefit the environment.

3. Compare the economics of using a rye cover with conventional chemical and mechanical methods of weed control.

4. Conduct an effective outreach program with farmers, Soil Conservation Service and extension personnel as the targeted group.

Results

In the first experiment, fall-planted winter rye was killed via three methods (glyphosate, mowing and tillage) and at three different growth stages (tillering, boot, and pollination). Rye that was killed with herbicide (glyphosate) plus mowing adequately controlled weed populations equal to the herbicide treatment checks. Rye killed by chisel plowing did not adequately control weeds at any stage. The exception was that rye killed at the tillering stage with glyphosate exhibited a significant decrease in weed control compared to herbicide checks, perhaps due to the lower quantity of rye biomass.

The second experiment conducted at Arlington evaluated rye and oats in combination with a hairy vetch companion crop for weed control in no-till soybeans. The oat winter-killed (as expected) and the rye was killed with glyphosate. There was no difference in percent weed control between the narrow row soybeans planted into rye and the narrow row or wide row soybeans with no cover that received an application of a preemergence herbicide. The weed control for all these treatments range from 88 to 95% control.

The third experiment evaluated four herbicides and cultivation for their ability to control rye which re-tillered after mowing in the boot stage. The objective was to enhance the

allelochemical control of annual weeds by allowing additional rye biomass accumulation after planting soybeans in 30" rows. All grass herbicides, applied 14 or 21 days after mowing, adequately (83%) controlled the re-tillering of the rye, regardless of the herbicide application rate. Cultivating twice controlled the rye at levels comparable to the grass herbicide treatments.

Results indicate that several of the systems tested offer potential to reduce the amount of herbicide used in a no-till soybean production system. Mowing rye in the tillering and boot stages did not prevent rye from retillering, and this rye regrowth behaved as a competitive weed. Rye mowed in the pollination or heading stages had very little regrowth, but planting soybeans in early June is later than ideal, especially if an early frost occurs as it did in 1989.

Due to the later rye planting date in the fall of 1989, the 1990 soybean trial had considerably less rye biomass than the 1989 trial. Rye gave adequate annual weed control when it was killed in the boot and pollination stages by glyphosate or by mowing and leaving the forage in the field. Even when the rye was removed as forage at these growth stages, early season weed control in soybeans was acceptable. Killing rye with a chisel plow at any date essentially removed both the allelopathic and mulch effects of the rye on weeds.

In 1989, soybean yields in plots with rye that did not receive additional herbicide were highest when rye was killed with glyphosate in the tillering and boot stages or with glyphosate or mowing when rye was in the pollination stage (average of 39 bu/acre). However, the overall highest yields were obtained in the treatments without rye and with herbicides to control weeds (average of 55 bu/acre). In both years the use of herbicides in addition to rye increased yields for each method of killing rye in the tillering stage, for the mowed and chisel-plowed plots in the boot stage, and for the chisel-plowed treatment at the pollination stage.

Economic analyses showed that the only systems that were competitive with soybeans grown without rye were those where rye was harvested as a forage rather than being left in the field. This is a feasible system for a dairy producer and has the added advantage that the soybeans could be heat treated and fed on the farm to replace purchased protein supplement. Estimates are that this use already accounts for over 15% of the soybeans produced in Wisconsin and projections indicate that as many as 40% of our production may be used directly in dairy rations in the future.

The rye-based systems had the lowest weed management costs, but the lower yields in these systems resulted in the non-rye based systems being more profitable. However, producers should consider the value of soil erosion protection given by the rye cover crop, enhancement of soil organic matter, and recycling of nitrogen through the rye when evaluating the economic aspects of rye-based weed management systems.

Project Duration: Two years
Funding: $60,150: $31,150 in 1988; $29,000 in 1989

Matching: $50,709

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Rodale Institute, $21,075, ($31,734)
University of Wisconsin, $34,725, ($14,625)
Farmers, $4,350, ($4,350)

LNC89-22: DEVELOPMENT AND DEMONSTRATION OF METHODS TOWARD SUSTAINABLE APPLE PRODUCTION

(Revised 3/6/91)

Major Participants:

Michigan State University: Stuart H. Gage (Project Coordinator), Department of Entomology, East Lansing, Michigan 48824, Phone: (517) 355-1855. Provides research guidance, orchard site for research activity, Kellogg Biological Station (KBS), and provides technical support for experimental design and data base development. Marion Lennington, M.S. candidate, Entomology, conducts research design, setup, monitoring and data analysis.

Rodale Institute: James Tjepkema, Midwest Coordinator, On-Farm Research, Box 128, Clarksgrove, MN 56016. Provides a liaison network between MSU, the grower cooperator and Rodale Institute.

Farmer Participant:

John Van Newenhizen, Double J Fruit Ranch, Benton Harbor, MI. Provides an orchard block for research activity and does all management and maintenance of the orchard.

Overview

As public concern grows about the amount of chemicals used in apple production, some producers are seeking biological and low-chemical input pest control measures. Through this project, a quantitative biological monitoring and delivery system was developed to help producers collect and quantify standardized observations on pests so treatments could be compared. This project will examine and evaluate alternative plant and animal systems in the apple orchard ecosystem to increase biological diversity for pest reduction and enhance predator effectiveness in orchards.

Objectives

1. Develop a biological monitoring system for assessment of sustainable apple production with cooperators in the Rodale Farm Network.

2. Evaluate plantings to enhance predatory insects and use animals to manage weeds and control insects in fallen apples.

Results

Research was undertaken at two sites: a 2.50 acre experimental orchard at Michigan State University's KBS at Hickory Corners, MI and a 3.75 acre 20-year-old experimental apple block on the Double J Fruit Ranch, a commercial mixed fruit farm near Benton Harbor, MI. The KBS orchard was planted in 1983 in selected scab resistant cultivars: "Red Free", "Priscilla" and "Liberty". To date, no pesticide or other chemical applications have been made and the apples have not shown any evidence of disease damage although they do have significant codling moth, apple maggot, and plum curculio damage. The organic apple block at the Double J Fruit Ranch is being used as a pilot model to enable later incorporation of the remainder of the Ranch under low-input strategies.

During the first year of the project (1990), several initiatives were begun:

A block in the KBS orchard and the experimental block at the Double J Fruit Ranch were subjected to codling moth pheromone disruption. Codling moth is a significant apple pest which is responsible for the "wormy apple" syndrome. The disruption techniques used Consep TM membrane disruption dispensers, which are strips of foil impregnated with codling moth female sex pheromone. These strips of foil may be easily wrapped around the branches of trees. The dispensers emit minute amounts of pheromone, imitating the emissions of female moths. When dispensers are concentrated sufficiently within an area, they saturate the air with pheromone chemical. The male moths become confused since they cannot locate females through this thick chemical "fog". They continue flying around in this intensely perfumed area, trying to locate females until they die from exhaustion. In theory, then, mating is "disrupted" or prevented since males are unable to find a mate.

At KBS and at Double J Fruit Ranch, male detection of pheromone signaling was monitored for both first and second generations of moths. During both generation cycles at KBS, lower numbers of male moths were caught in the disrupted block than in the undisrupted areas, except for one week during the second generation when there was an isolated peak in male moth catch in the disrupted block. This peak may have been due to a population explosion occurring in the second generation. Codling moth apple damage was lower in the disrupted block than in the undisrupted areas. At the Double J Fruit Ranch, male moth catches in the disrupted experimental block were lower than in a check block on the farm. Damage was also 40-60% lower than the previous year.

In conclusion, disruption pheromone can reduce matings among codling moth populations considerably. However, since codling moth populations in the East and Midwestern states (including Michigan) tend to be high, other measures in addition to disruption are necessary to reduce the level of codling moth damage. In 1991, the project will include the use of B.t. (*Bacillus thuringiensis*), a biological control, on codling moth larvae. Precise timing of B.t. applications will be facilitated by onsite weather instrumentation.

Populations of predatory insects, lacewings and ladybird beetles, were monitored from May to September at both sites. The KBS orchard had higher densities and greater variety of ladybird beetles and lacewings than Double J Fruit Ranch. Presumably, this is due to the

presence of alfalfa, corn, oat, and other grain fields around the KBS orchard, which provide alternate habitat and food for predators. In contrast, Double J is surrounded by orchards, to which fewer species of ladybird beetles are biologically adapted. Both orchards demonstrated higher densities of lacewings than ladybird beetles overall. This may indicate that lacewings are more adaptable to trees and orchard environments than ladybird beetles. Lacewings also were present more continuously throughout the season at both sites than ladybird beetles.

Chickens were introduced in the KBS orchard to evaluate their efficacy in reducing damage by the plum curculio and other pests. The chickens were fenced in directly under the trees in four of the orchard rows and foraged continuously from July to September. Harvest data indicated that damage by plum curculio was 25-40% lower in the chicken rows than the rows where there were no chickens. Codling moth damage was also lower in the chicken rows; however, this may have been an effect of orchard location which will be examined in 1991.

An unanticipated but highly significant effect of the chickens was their ability to strip underlying tree vegetation to bare ground. This effect was due to foraging, trafficking, and the toxicity of chicken waste on the weeds. In many orchards, "herbicide strips" are created along the tree rows to eliminate weed competition for water and nutrients. The chickens showed a similar effect to herbicides to reduce weed populations. The chickens' potential as an alternative to herbicides will be investigated more closely in 1991.

Project Duration: Three years
Funding: $42,500: $24,500 in 1989-91; $18,000 in 1991-92
Matching: $27,898

1991 Continuation

LNC89-22.1: DEVELOPMENT AND DEMONSTRATION OF METHODS TOWARD SUSTAINABLE APPLE PRODUCTION: CONTINUATION OF SYSTEMS INTEGRATION

Overview

Through this continuation, researchers pursued methods for significantly reducing the chemicals applied in commercial apple production. They also will examine new pest control strategies and market options to optimize the land resource in small orchards so that small or part-time farmers might obtain value in the integration of other crops and animals into orchard ecosystems.

During 1990, development toward sustainable apple production was initiated at the KBS orchard and at the VanNewenhizen's mixed fruit farm near Benton Harbor, Michigan. Observations and data collected during 1990 included the following components related to low chemical pest reduction systems: the introduction of chickens as pest control agents and weed foragers; the adoption of pheromone disruption as an alternative technique for codling moth control; monitoring of predatory insect diversity and density; and a farmer's market survey of the acceptability of disease-resistant fresh apples and dried apple products to consumers.

This project will help substantiate that studying only single components of a system as complex as an apple orchard will not yield information to enable practical implementation. The multifaceted systems approach taken here will provide growers with new ideas, unique strategies and quantitative information to enable them to undertake a sustainable approach to orchard systems using low inputs.

Objectives

1. Determine the effectiveness of chicken foraging as an alternative to herbicides in apple orchards;

2. Quantify the degree of plum curculio, codling moth and Japanese beetle control effected by chickens;

3. Document the economic benefits/costs of placing chickens within the orchard, of growing and marketing disease-resistant apples and of intercropping; and

4. Measure the effect of codling moth pheromone disruption as an environmentally safe alternative to insecticides for control of codling moth.

This project is examining the potential for significantly reducing chemical applications in apple orchards as well as new pest control strategies, market options and designs to optimize land resources in small orchards. The latter feature would help producers benefit from the integration of produce or other crops into the orchard system. A quantitative biological monitoring and delivery system is being developed to provide orchardists the ability to collect and quantify standardized observations on pests and apple production so treatments can be compared across the low-input orchard network.

Monitoring was conducted on four apple insect pests (codling moth, plum curculio, apple maggot and japanese beetles) and two beneficial insects (lacewings and ladybird beetles). Visual and trap monitoring of these insects was correlated with weather data to determine appropriate timing for biological controls. Mating disruption was chosen as the biological control method for codling moth at both experiment sites. Researchers found that the disruption technique provided a significant degree of control during years with normal temperatures, but that because of the high pest population, an additional control method would be necessary. Scouting counts would indicate that lacewings may be more suitable than ladybird beetles as orchard predators because lacewings are less particular about food or habitat. Lacewings were consistently found in higher numbers and more continuously. In one case, a producer introduced 20,000 13-spotted adult ladybird beetles in his orchard, all of which left. Lack of food, strange habitats or life-state may have induced them to leave. Larval predators may be better control agents since their focus in life is eating.

A computer program is being developed to provide statistical analysis and management information. Data collected during the two-year period from a farm and from an experimental orchard will provide an example set of observations on pests and production.

The second goal of this project is to examine and evaluate the benefits of including other plant and animal systems in the apple orchard ecosystem to increase biological diversity for pest reduction and enhance predator effectiveness. During two production seasons, Barred Rock

chickens were tested as a biological control agent of plum curculio, Japanese beetles and weeds. It was found that chickens, when introduced early enough in the season, can reduce vegetation competition as effectively as any herbicide. The success of their weed control was related to the climate and time when they were introduced. The project also studied the chickens effect on controlling insect pests. Control of the plum curculio and Japanese beetle improved, although there was no effect on control of the codling moth.

The project also studied consumer demand and marketing needs for new low-chemical input, disease-resistant varieties. A market survey conducted with 100 people at a farmer's market indicates that consumers would enjoy the Redfree disease-resistant variety at least as well as the varieties they typically bought on the market.

LNC89-23: LISA IMPACTS: SOCIAL, ECONOMIC, AND DEMOGRAPHIC IMPACTS OF LOW-INPUT SUSTAINABLE AGRICULTURE PRACTICES ON FARMS AND RURAL COMMUNITIES IN THE NORTHWEST AREA

(Revised 3/6/91)

Major Participants:

North Dakota State University: David L. Watt (Project Coordinator), Department of Agricultural Economics, State University Station, P.O. Box 5636, Fargo, ND 58105-5636, Phone: (701) 237-8011. Gary A. Goreham, Rural Sociology, Fargo, ND 58105, designs research and conducts surveys; analyzes data.

South Dakota State University: Sue Wika, Rural Sociology, Brookings, SD, analyzes data.

Farmer Participant:

Terry Jacobson, Wales, ND, assists with conceptualization and operationalization in survey design; assists with interpretation of findings.

Overview

The impacts of low-input sustainable agriculture (LISA) on farm economics, farm families, farming communities, regional centers, and state revenues is addressed in this research project. Paired comparisons were made between LISA and non-LISA farming operations in North Dakota. During the summer of 1989, questionnaires were designed and pretested. LISA farmers were paired with non-LISA farmers to provide research controls and to allow for comparisons of the two groups. A total of 35 operators involved in various NDSU Agricultural Experiment Station LISA production projects were surveyed. For each of these respondents, conventional operators in the same area, and with operations similar to those of the LISA farmers, were surveyed.

Results

When the two farming situations were compared, no differences were found in the number of days the two groups worked off the farm. No differences were found between the two groups in the proportion of spouses who held off-farm employment, nor in the number of hours they worked off the farm.

No statistically significant differences were found in the number of acres owned by LISA and conventional farmers, nor in the number of acres they rented to others. Conventional farmers rented more acres from others (1281.8 acres) than did LISA farmers (510.3 acres). No differences were found between the two groups in the number of acres in the conservation reserve program (CRP), in pasture, hayland, rangeland or in woodland. No differences were found between the two groups in the use of no-till practices.

The farmers were asked how many acres of various types of crops they raised. Differences were found only in two types. LISA farmers raised more acres of buckwheat (15.7 acres) than did their conventional counterparts (0.0 acres) but conventional farmers raised more acres of barley (104.3 acres) than did LISA farmers (48.8 acres). No differences were found in the percent of feed or seed the two groups purchased that had been grown in their respective counties. LISA farmers sold a greater proportion of their crops through organic markets (54.5%) than did the conventional farmers (0.0%).

The farmers were asked how many years they used various farming practices. Conventional farmers had used conventional practices for an average of 23.8 years compared with 13.7 years for LISA farmers. No statistically significant differences were found in the number of years the two groups used no-till practices or organic practices. No statistically significant differences were found between the two groups in the number of acres they had in rotation with summer fallow, in the number of years they did soil sampling, or in the number of years they scouted for weeds and/or insects. No statistically significant differences were found in the percentage of cropland where the two groups applied insecticide, fungicide, or herbicide. However, conventional farmers applied commercial fertilizer to an average of 63.1% of their cropland compared with LISA farmers who applied commercial fertilizer to an average of 37.9% of their cropland. LISA farmers used green manure for fertilizer on an average of 5.6% of their cropland and conventional farmers used green manure for fertilizer
on an average of only 0.9% of their cropland. No differences were found between the two groups' use of animal manure.

No statistically significant differences were found between the two groups in the value of their farm assets or in the value of their farm liabilities. However, differences between the two groups were found in both their gross farm incomes and net farm incomes. Conventional farmers grossed an average of $104,057 in 1989 compared with $63,317 for LISA farmers. Conventional farmers netted an average of $21,530 in 1989 compared with $6,032 for LISA farmers.

Although no statistically significant differences were found between the two groups, one-third of LISA farmers (36.4%) and conventional farmers (32.4%) believed that the current programs kept them from planting a desired crop rotation. Whereas 18.2% of the LISA farmers and 29.4% of the conventional farmers believed current farm programs damaged their conservation efforts, the difference was not statistically significant. However, when asked if current farm programs promoted conservation efforts, 57.6% of the LISA farmers and 23.5% of

the conventional farmers agreed that they did.

Additional analysis will be conducted comparing the two groups of farmers and their financial viability, providing information on the impact of LISA on the community, sub-state region, and state.

Project Duration: Two years
Funding: $65,300 in 1989
Matching: $65,300

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

North Dakota State University, $57,300, ($57,300)
South Dakota State University, $8,000, ($8,000)

LNC89-24: CROP ROTATION, LEGUME INTERCROPPING AND CULTURAL PEST CONTROL AS SUBSTITUTES FOR PURCHASED INPUTS IN A CASH GRAIN SYSTEM

Major Participants:

Purdue University: David B. Mengel (Project Coordinator), Soil Fertility, Crop Production, Dept. of Agronomy, West Lafayette, IN 47907, Phone: (317) 494-4600. James J. Vorst, Crop Physiology; Michael Pitzer, Crop Production.

Overview

Little data is available comparing both the agronomic and economic advantages of cash grain cropping systems which use varying levels of purchased chemicals and fertilizers. This study compared four alternative cropping systems, at varying levels of purchased inputs. Comparisons made will focus on productivity of the systems using traditional yield measurements, profitability of the systems in both short and long-term economic terms, and the effects of these systems on the long-term productivity of the soil. Cropping systems used will include continuous corn, a corn/soybean rotation, a corn/soybean/wheat rotation, and a corn/oats/canola rotation.

Within each rotation four levels of purchased chemical and fertilizer inputs will be used. Level one will involve no purchased inputs and will rely totally on cultural weed and pest control. Level two will attempt to produce 90% of the yields of the more input-intensive systems with less than 50% of the purchased fertilizers and chemicals. Where appropriate, legume intercrops will be included in both levels one and two. Level three will use "normal" input usage as recommended by the Indiana Cooperative Extension Service, and level four will use input levels commonly recommended by the more aggressive dealers in the state. An additional component of the three year rotations will be how the time after harvest of wheat or canola will be utilized. In input levels one and two, this time will be utilized for legume production. However in input levels three and four, a cash crop such as soybeans or sorghum will be grown.

Objectives

1. Determine the effect of crop rotation, at different levels of purchased chemical and fertilizer input, on the productivity and profitability of the cropping system.

2. Determine the effects of crop rotation, legume intercropping and varying levels of purchased fertilizer inputs on the fertility and productivity and physical properties of the soil over time.

3. Determine the influence of crop rotation and varying levels of chemical and mechanical weed control on weed populations and species shifts over time.

Project Duration: Two years
Funding: $53,000 in 1989
Matching: $50,000

LNC89-25: SYNCHRONY AND CONTRIBUTION OF LEGUME NITROGEN FOR GRAIN PRODUCTION UNDER DIFFERENT TILLAGE SYSTEMS

Major Participants:

Kansas State University: J.L. Havlin (Project Coordinator), Dept. of Agronomy, Manhattan, KS 66506, Phone: (913) 532-6011. C.W. Rice, Soil Microbiology; J.P. Shroyer, Crop Science; D.L. Devlin, Weed Science Extension; D.L. Regehr, Weed Science.

The Land Institute: P.A. Kulakow, Plant Breeding, 2440 E. Water Well Rd., Salina, KS 67401.

The Kansas Rural Center: D. Ebbert, Agronomist, 304 Pratt St., Box 133, Whiting, KS 66552.

Overview

Successful low-input sustainable agriculture systems depend on sufficient quantities of available nitrogen from legume crops preceding non-legume crops. Ideally, the period of maximum nitrogen mineralization rate should overlap or coincide with the period of maximum rate of nitrogen uptake for the non-legume crop. Synchronization of nitrogen mineralization and crop nitrogen uptake for potential low-input sustainable crop rotations needs must be quantified to improve the scientific basis for recommendations to farmers. In addition, reduced dependence on herbicides also is a critical component of LISA systems. Increased emphasis on reduced tillage systems on highly erodible lands will influence weed control management and nitrogen management. This project evaluated and quantified the effects of several legume crops on the contribution and synchrony of legume nitrogen to winter wheat and grain sorghum produced under three tillage systems.

Objectives

1. Quantify nitrogen mineralization from forage and grain legumes and subsequent nitrogen availability to non-legume grain crops.

2. Evaluate the influence of tillage on the quantity of nitrogen mineralization and availability to grain sorghum and winter wheat.

3. Describe and quantify the synchrony of soil and legume nitrogen mineralization and nitrogen uptake by non-legume grain crops.

4. Evaluate the potential use and nitrogen balance of mono- and poly-culture production of perennial grain crops.

Project Duration: Two years
Funding: $95,081 in 1989
Matching: $155,074

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Kansas State University, $69,081, ($143,799); and
The Land Institute, $26,000, ($11,275)

LNC90-26: ECONOMIC, ECOLOGICAL AND ENVIRONMENTAL ANALYSIS OF A FARM UNDER LONG-TERM LISA MANAGEMENT

Major Participants:

Ohio State University: Benjamin R. Stinner (Project Coordinator), Entomology, Phone: (614) 292-6446. Clive Edwards, Entomology; John Blair, Entomology; Nancy Creamer, Entomology; Kamyar Enshayan, Agriculture Engineering; Deborah Stinner, Entomology; Sam Traina, Agronomy; Marvin Batte, Agriculture Economics; Dave McCartney, Entomology; John Bater, Entomology; Patrick Bohlen, graduate student, Entomology; Michelle Wander, graduate student, Entomology; Roman Kuperman, graduate student, Entomology.

Wisconsin Rural Development Center: Jess Ennis, Economist.

Michael Fields Agricultural Institute: Walter Goldstein, Soil Amendments; John Hall, Soil Fertility.

Rodale Research Center: Rhonda Janke, Agronomist; Kim Kroll, Systems Scientist.

Farmer Participants:

Hartzler Family, Smithville, OH; Rex and Glen Spray, Mount Vernon, OH; Elston Family, Grover Hill, OH.

Overview

This proposal requests funding for a multidisciplinary study that will provide for an economic and ecological systems analysis of three established lower chemical input farms. These farms have been under lower chemical input management for up to 25 years and represent a range of farm systems in the North Central Region. The farms include the Hartzler's dairy/field crop farm in northeast Ohio, the Spray's beef/field crop farm in central Ohio, and the Elston's cash grain farm in northwest Ohio. A major aim will be to provide data on combined animal and crop production.

The economic analyses is based on detailed farm budget records maintained by the cooperating farmers. All inputs of labor, chemicals and machinery were recorded and added to fixed costs and assessed against returns. All livestock cost records were assessed against milk and livestock sales. Nutrient budgets were derived from use records and analyses of materials (manure, feed and fodder, etc.) within each farm. The soil biological, physical and chemical characteristics were reported for each farm and on-farm experiments were conducted to assess the influence of various soil amendments on soil fertility and crop growth.

Objectives

1. To develop whole-farm economic budgets and document management practices for three family-operated low chemical input mixed crop/livestock and cash grain farms.

2. To assess nutrient cycling and energy budgets of the farming systems in relation to biological, cultural, ecological and environmental processes at the farm-level.

3. To evaluate the influences of chemical and organic soil amendments on soil chemical, biological and physical characteristics, pest disease and weed incidence and on crop growth.

4. To provide sites for graduate student internship program projects.

5. To provide information from on-farm studies which can be disseminated through on-farm demonstrations, workshops and a farmer-mentor/farmer-apprentice program within the North Central Region.

Project Duration: Two years
Funding: $92,344 in 1990
Matching: $238,019

LNC90-27: ROTATIONAL GRAZING SYSTEMS FOR WISCONSIN AND MINNESOTA DAIRY FARMERS -- AN EVALUATION OF ANIMAL AND FORAGE PERFORMANCE AND WHOLE-FARM ECONOMIC ANALYSIS

Major Participants:

University of Minnesota: Craig Sheaffer (Project Coordinator), Agronomy and Plant Genetics, St. Paul, MN 55108, Phone: (612) 625-8761. Ken McNamara, Agronomy; Kent Olson, Agricultural Economist; Neal Martin, Agronomist.

University of Wisconsin: Ken Albrecht, Agronomy; Michael Casler, Agronomy; Steve Stevenson, Sociologist; David Combs, Dairy Scientist; Richard Klemme, Agricultural Economist.

Land Stewardship Project: Richard Ness, Animal Scientist.

Wisconsin Rural Development Center: Denny Caneff, Agricultural Journalism.

Southern Wisconsin Farmers' Research Network, Inc.: Carl Fredericks, Agricultural Resources.

Overview

Rotational grazing systems have the potential to improve the economic viability for many dairy farmers in Wisconsin, Minnesota and other North Central states. Rotational grazing can reduce building and machinery costs, as well as reduce annual crop input expenses over confinement systems that rely mainly on row crop production for cattle feed. A significant environmental benefit is possible from keeping land in permanent cover.

The on-farm portion of the project involved three clusters of farmers (two in Wisconsin; one in Minnesota) who were experienced in using rotational grazing systems. Information was collected to evaluate performance of perennial grasses, pasture establishment methods, and effects of rotational grazing on yields of forage; milk; animal health; and the farm family. An in-depth financial analysis of six farmers allowed for the comparison of rotational grazing and confinement systems.

Replicated experiment station trials were conducted at Arlington, WI and at Rosemount, MN. The Wisconsin work focused on forage and cow performance with rotational grazing of alfalfa and legume-grass pasture as compared to confinement systems. Alfalfa varieties and ration balancing also were evaluated. The Minnesota work examined the effects of stocking rates on animal gains and legume persistence using rotational grazing as compared to conventional continuous grazing systems.

Objectives

1. Evaluate dairy animal and forage performance using RG systems,

2. Conduct whole farm socio-economic analyses of farmers who have adopted RG methods, and

3. Explore research demonstration and outreach approaches which involve new relationships between farmers, university researchers, non-profit organizations, and cooperative extension.

Results

Experiment station and on-farm research has proven that intensive rotational grazing can be a profitable alternative to conventional confined feeding systems for milk production. In both experiment station and on-farm research on rotational grazing, there is a continual evolution in pasture and animal management by researchers and producers. Interactions of farmers, university researchers, non-profit farm organizations and cooperative extension were effective in focusing energies and resources on solving urgent problems associated with rotational grazing.

To meet the first objective of the study, dairy cow performance was compared in rotational grazing and a conventional stored feeding system. An economic analysis indicated that net return per cow was $64.05 and $88.66 greater in 1991 and 1992, respectively. The pasture system resulted in lower receipts each year than the confined system but expenses were significantly lower. The rotational grazing system used in this experiment for two seasons resulted in an average 482 lb of 4% fat corrected milk less per cow during a pasture season (mid May to early October) compared to confinement feeding of good quality forage. The treatments did not affect percent protein in the milk. Adequate amounts of good quality forage were maintained for grazing on the grass pasture most of the time. Milk production dropped when the pasture matured and increased again when better quality pasture became available.

While cows on pasture produced less milk of lower fat content, savings resulted from less feeding of stored feeds, less use of facilities and equipment, and less labor. Consequently, net returns per cow were consistently greater for the pasture system.

To meet the second objective of this project, the productivity of a rotational grazing system with two pasture types (pure alfalfa or a mixture of alfalfa-red clover-smooth bromegrass and orchardgrass) was compared to a conventional stored forage (alfalfa silage) animal confinement dairy system. Productivity was assessed in terms of agronomic (forage yield, quality and persistence), and animal production (milk yield and composition).

The same grain mix was used for cows on both the pure alfalfa and the mixed forage pastures because forage quality was similar between the two pastures. The grain mix formulated for the cows on pasture contained more bypass protein (more corn gluten feed and less soybean meal) than the grain mix used for the confined cows to account for higher degradability of protein in fresh forages than in ensiled forage. Supplemental grain was fed according to lactation number, level of milk production and estimated forage quality. Because forage quality of the pastures was higher than quality of the ensiled alfalfa, less supplemental grain was fed to the cows on pasture than to the cows in confinement.

To meet the third objective, producers tried alternative methods of introducing legumes into pastures. The alternative methods, all of which reduced soil erosion when compared to conventional tillage, were frost seeding, broadcast seeding following minimum tillage (discing, cultimulching), and animal impact. Red clover was the legume most easily established, while alfalfa and birdsfoot trefoil were more difficult to establish. Frost seeding was the lowest cost

and most effective way of introducing legumes into existing sod. All attempts at feeding seed in the cattle mineral (thus letting the cows distribute the seed in their manure), were unsuccessful.

An economic analysis comparing pasture farms to conventional (largely confinement feeding) farms follows. However, these results are for only one year (1991). Many of the farms in the conventional group were much more diversified than the pasture group, which tended to be mainly dairy. Since 1991 was a year of extremely low milk prices, pasture farmers had poorer than expected returns relative to the more diversified conventional farms. A more equal comparison in farm size and business (comparing strictly dairy/on farm crop use operations) will be attempted in future analyses. Also, some changes are being made in the analytical model to allow for machinery which is on the farm but not being used (on the farms making the transition to grazing).

Project Duration: Two years, ending Sept. 1, 1993
Funding: $118,700 in 1990
Matching: $72,320

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Minnesota, $31,107, ($28,120);
University of Wisconsin, $38,298, ($24,400);
Wisconsin Rural Development Center, $49,295, ($19,800).

LNC90-28: THE KRUSENBAUM FARM -- A CASE STUDY AND MODEL IN THE ESTABLISHMENT OF AN ORGANIC DAIRY FARM

Major Participants:

University of Wisconsin: Joshua Posner (Project Coordinator), Agronomy, Phone: (608) 262-1234. Jerry Doll, Agronomy; Gary Frank, Agriculture Economics; Janet Harrison, graduate student, Agronomy; Leonard Massie, Agricultural Engineering; Ron Schuler, Agricultural Engineering; Steve Stevenson, Center for Integrated Agricultural Systems.

AGSTAT: Jon Baldock, Crop Consultant.

Walworth County Extension Service: Lee Cunningham, Agricultural Extension Agent.

Michael Fields Agricultural Institute: John Hall, Agronomist.

Farmer Participants:

Bernie Kleiber, Whitewater, WI 53190; Altfrid Krusenbaum, Elkhorn, WI 53121; Alan Wood, Elkhorn, WI 53121.

Overview

Low-input sustainable agriculture is being promoted as a possible solution to many of the economic, social and environmental problems facing agriculture in the United States today. This project used the case study or whole farm approach, which allowed researchers to study not only the biological and financial constraints associated with converting to an organic system, but also to quantify what will perhaps be the most constraining factor -- labor and managerial expertise.

The Krusenbaum farm is a 240-acre dairy/cash grain farm in East Troy, WI. The team working with the family includes UW-Extension Specialists, the Walworth County Extension Agricultural Agent, a crop consultant, members of the Michael Fields Agricultural Institute staff, and several area farmers. During the first three years of the project, the team made a physical and natural resource inventory of the farm, initiated biological monitoring of the crop and animal enterprises, and put in place a land and water management plan as well as a low-input rotation. Financial record keeping with a computer-based spreadsheet, a written decision diary, and monthly in-depth interviews were used in order to follow cash and labor flows as well as chronicle the decision-making process.

Objectives

Short-term objectives for the farm include:

1. A marked reduction in soil erosion (T< 2T/A/yr);

2. A net income of $14-18,000/year;

3. Milk production levels of 17,000 lbs/year;

4. Crop yields approximating the county average;

5. A reduction in foxtail, quackgrass, velvetleaf and pigweed infestations; and,

6. Nitrate leaching equal to that found under native prairie grasses as estimated by fall and spring deep nitrate sampling.

Project Duration: Two years
Funding: $70,748 in 1990
Matching: $99,709

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Michael Fields Agricultural Institute, $18,980, ($13,060); and
University of Wisconsin, Madison, $51,768, ($86,649).

LNC90-29: SUSTAINABLE PRODUCTION SYSTEMS FOR VEGETABLES

(Revised 3-6-91)

Major Participants:

Purdue University: Stephen C. Weller (Project Coordinator), Horticulture, Phone: (317) 494-4600. Glen Sullivan, Economist, Horticulture

University of Illinois: John B. Masiunas, Horticulture (Co-Project Coordinator). William Shoemaker, Extension Specialist

Farmer Participants:

Daniel Hinkle, Farmer and Chairman of Illinois Specialty Growers Association, Cissna Park, IL

David Rietveld, Kouts, IN

Overview

Vegetable production is energy intensive and environmentally threatening, requiring large inputs of water and agricultural chemicals. In order to maintain sustainability of small to moderate sized production units, alternative production systems must be developed. These systems must be environmentally and economically viable. Thus an alternative system needed to be developed for fresh market production of snapbeans, cabbage and tomatoes. This system was based on using interseeded hairy vetch and rye as a fall cover to protect the soil, provide nitrogen to the crops and allow reduced pesticide use as a result of allelopathic properties of the rye. The experiment used a three-year rotation of cabbage, snapbeans, and tomatoes in association with the cover crops.

The cover crops were managed using two methods. The first involved spring cultivation of the hairy vetch and rye into the soil, resulting in improved soil tilth and providing nitrogen to the crop. A second method left the cover crops on the soil surface, maximizing the allelopathic potential of the rye for weed control and providing a reduced tillage approach to minimize soil erosion. Information from these field studies and surveys of small to moderate sized conventional and sustainable vegetable growers were used to determine the potential risks, costs and economic returns of various production systems (alternative and conventional).

Objectives

1. Develop sustainable production systems for small to moderate sized vegetable farms;
2. Evaluate the economics of alternative vegetable production systems; and
3. Disseminate information on sustainable vegetable production to potential users.

Project Duration: Two years

Funding: $78,321 in 1990
Matching: $75,094

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Purdue University, $41,967, ($46,607); and
University of Illinois, $36,354, ($28,487).

LNC90-30: RUMINANT PRODUCTION SYSTEMS INTERRELATED WITH NON-TRADITIONAL CROP MANAGEMENT

(Revised 1/10/91)

Major Participants:

North Dakota State University Carrington Research Extension Center: Vernon L. Anderson (Project Coordinator), Box 219, Carrington, ND 58421, Phone: (701) 652-2951. John C. Gardner, Plant Science.

NDSU Main Research Station: Stephen Boyles, Animal Science, and James E. Struble, Microbiology. David L. Watt, Agricultural Economics.

NDSU Hettinger Research Extension Center: Timothy Faller, Animal Science.

Farmer Participants:

Farmer-cooperators with integrated crops-livestock systems will conduct on-farm evaluations of low-input beef cows and sheep.

Overview

This study evaluated the practical, environmental and economical aspects of adding ruminant livestock to farms using traditional versus non-traditional crop management systems. Livestock trials were conducted with lactating beef cows and ewes using high residue diets supplemented to make balanced rations. Two milk production levels were studied with diets balanced to match productivity level using residues and cropping system products. One-fourth of the calves from average milking cows were weaned early, one cycle before the end of the 45-day breeding season. Early-weaned calves will be offered diets with and without probiotic supplements. Calves weaned normally will be fed screenings versus barley-based backgrounding diets with and without probiotic supplements.

The sheep production component evaluated three diets 1) alfalfa; 2) alfalfa/wheat straw; and 3) alfalfa/corn stover, in year-round confinement. Manure collected was quantified and analyzed for fertility value. Manure production was quantified and analyzed in the cow and sheep components of the study. Cow manure was composted and returned to the fields in the cropping system.

Two previously initiated four-year cropping systems (a conventional wheat-sunflower-barley-fallow system versus a low-purchased-input system of wheat with underseeded legume-legume-hay-corn-soybean) also were compared. Three different tillage systems: 1) no till, 2) minimum till and 3) conventional till were evaluated in field-sized plots. Three fertility levels with commercial fertilizer were applied plus composted cow manure at 6 tons per acre.

Data generated from cropping system study and livestock trials was entered into a "Low-Purchased-Input Farming Systems" (LPIF) model for linear programming analysis. Comparisons were to include: 1) traditional farming practices for crops only enterprises, 2) LPIF for crops only enterprises and 3) LPIF for crops-livestock (beef cows or sheep). Coefficients of production (grain yield, residue harvested) developed from the cropping system study were to be used to determine economic potential and model the ruminant carrying capacity. Numbers of animals will be limited by labor, feed supply or other variables considered in the formula.

Project Duration: Two years
Funding: $108,700 in 1990
Matching: $108,700

LNC91-31: COMPOST EXTRACTS AND THE BIOLOGICAL CONTROL OF FOLIAR PLANT DISEASE

Major Participants:

University of Wisconsin, Madison: John H. Andrews (Project Coordinator), Plant Pathology Department, 1630 Linden Drive, Madison, WI 53706, Phone: (608) 262-1234. Robin F. Harris, Soil Science.

Michael Fields Agricultural Institute: H.H. Koepf, President, East Troy, WI, agriculturalist; John Hall, research agronomist.

Farmer Participants:

Ela Orchard: Bob Willard and Edwin Ela, sheep producers, Rochester, WI.

Overview

Economic losses due to foliar disease are difficult to estimate, but are on the order of $1 billion annually in the US for frost injury alone. Fungi account in large part for such diseases. Relatively few new fungicides are entering the marketplace and many are being withdrawn voluntarily or forcibly because of health risks (e.g., about 90% by weight of all fungicides now applied are potential oncogens).

Composts have long been known to suppress or control soilborne pathogens. Recent research indicates it also can effectively reduce foliar disease. This project tested the efficacy of such extracts in a model system, i.e., on apple trees for control of the apple scab fungus *Venturia inaequalis*. The scab disease is so serious that apples cannot be grown on a commercial scale in Wisconsin (or under moist temperate climates anywhere in the world) without effective control.

Objectives

In collaboration with the Michael Fields Agricultural Institute (East Troy, Wisconsin) and a commercial orchard operation, we will develop and test compost extracts for control of the apple scab disease.

1) To prepare composts of animal-based (manures) and plant-based (kitchen and garden wastes) origin;

2) To test water extracts of the composts of various ages for apple scab control at a university research station and at a commercial orchard; and

3) To make a preliminary determination of the mechanism of action of the composts as direct versus indirect (antagonism of pathogen versus induced host resistance), and microbial versus cell-free microbial.

The work will promote alternative agriculture by:

1) fostering economically competitive agricultural systems (reduced reliance on off-farm purchased inputs; conserved energy and natural resources; reduced environmental contamination and health risks); and

2) providing a scientifically based approach to low-input, sustainable, biodynamic practices, specifically with respect to approaches to and explanation for composts as they affect plant pathogens.

Results

Thirty-three composts, most of which are manure-based, were obtained from composting facilities in the Madison area. They ranged in maturity from days to months. The carbon to nitrogen ratio ranged from relatively high (wood chips) to low (earthworm castings; manure). In addition, project investigators prepared one compost (dairy cattle manure/straw/soil) and are in the process of preparing four others in cooperation with The Bruce Company (wood chips/soil and wood chips/soil/horse manure) and Agrecol Corp (beef cattle manure/soil/straw and grass/soil/straw). This allows for control of composition and age of the raw materials and management of the composting process.

During the first year of the project, aqueous extracts of 11 plant-or manure/straw-based straw composts were bioassayed for their ability to inhibit *Venturia inaequalis* and/or signs of the apple scab disease. Composts were incubated in water without agitation for 0-21 days. Incubation for seven or more days generally increased efficacy. Germination of *Venturia* conidia in compost extract (1:2 w/w compost:water) ranged from 3% to 101% relative to water controls. When compost suspensions were sprayed onto apple seedlings in a growth chamber prior to inoculation with the pathogen, the resulting relative disease severity (scale 1-5) after 10 days ranged from 1.0 to 3.5 units compared with water (1.9-3.5 units) and captan (1.0-1.2 units) controls. Conidia recovered from diseased plants were reduced from 27-98% vs. water (0%) or captan (99.9%). Preliminary evidence from experiments with nine composts suggested that

the inhibitory principle was in general heat stable and passed 0.22μm filters. The ranking of four composts evaluated to date in preliminary experiments by both the laboratory- and plant-based methods showed that the germination screen usually predicted relative performance in the plant assay.

Field trials with two of the more promising composts are in progress at the Madison West Side research farm and at Ela Orchard, a commercial operation in Rochester, WI. Researchers are also collaborating with W. Stevenson, Plant Pathology Dept, UW-Madison, who is testing extracts for the control of early blight of potato.

Project Duration: Two years, ending August 31, 1993
Funding: $70,000: $33,660 in 1991; $36,340 in 1992
Matching: $58,044

LNC91-32: TRAP CROPPING TO MINIMIZE INSECTICIDE APPLICATION AND FARM INPUT COSTS IN SUNFLOWER PRODUCTION

Major Participants:

North Dakota State University: Gary Brewer (Project Coordinator), Department of Entomology, Fargo, ND 58105, Phone: (701) 237-8011. H.R. Lund, Experiment Station Director; Roger G. Johnson, Agricultural Economics.

Farmer Participants:

Daryl Rott, farmer-cooperator and project initiator, Fredonia, ND.

Overview

Trap cropping is a specialized form of intercropping designed to minimize pest damage and enhance yield. The pest insect must be strongly attracted to the intercrop or at least a stage of the intercrop that coincides with or serves to protect the vulnerable stage of the main crop. Most trap crops work by attracting pests to a specific portion of the field where they can be concentrated and held on a crop where they do little or no economic damage or where they can be concentrated and destroyed. The trap crop can be the same or different from the main crop. However, yield is maximized if the trap crop is the same as the main crop because it then contributes to yield and minimizes competition.

The red sunflower seed weevil, *Smicronyx fulvus* LeConte, is a specific pest of sunflower and related species of *Helianthus*. Many fields in the major sunflower growing region of North Dakota, South Dakota and Minnesota are treated with insecticides yearly for seed weevil control. The red sunflower seed weevil is strongly attracted to blooming sunflower. This project examined designing a sunflower field to have early blooming trap rows of sunflower, with the main portion of the field blooming later. The early blooming trap rows attract immigrating seed weevils. If their numbers become sufficiently high they will be destroyed by insecticide application. This will result in a reduced need for off-farm inputs and will minimize

environmental contamination. A successful trap crop for seed weevils should also be more profitable due to the decreased cost of insecticide application.

Objectives

1. Determine the effectiveness of trap cropping to minimize seed weevil damage in sunflower.

2. Compare the cost effectiveness of trap cropping with standard practices to manage red sunflower seed weevil.

3. Determine the optimum cultural practices to attract seed weevils to trap rows.

4. Disseminate information from the farm trials with publications, field days and extension workshops.

Results

Trials were conducted on four sunflower farms in the summer of 1991 to determine the effect of trap cropping in controlling insects. In two out of three fields, infestation was higher in the trap fields than in the control fields, but yield differences were minimal, except for one farm where different varieties were planted and yield differences were large. On the fourth farm, the entire trap field was treated with an insecticide, therefore, no data was presented for that farm. The fields averaged 121 acres in size.

The economic data presented is not compatible with the Planetor/Budgetor generator. On two farms, the trap fields average net return per acre was about $5 higher than the net value of the control field. The large yield difference between the trap and control fields on the third farm is not attributed to the trap design but to the effects of the different varieties that were planted on the two fields.

To maximize the trap cropping design to increase sunflower profitability, certain conditions should be met. These are: the trap rows should flower before the main portion of the field flowers and the weevils in the trap rows should be controlled before the main portion of the field begins to flower. However, even when these conditions were not entirely met, the trap cropped fields were more profitable than the conventional fields. And the amount of insecticide used was only about 10 percent of that used in the conventional field. Because the interior trap rows did not attract and hold a high number of weevils compared to the main portion of the field, the central trap rows are not needed for a seed weevil trap cropping design.

Based on the 1991 results, the trap cropping system was successful in reducing the seed weevil infestation when certain conditions were met: the trap rows must flower before the main portion of the field flowers and the weevils in the trap rows should be destroyed before the main portion of the field flowers. However, even when the conditions were not entirely met, the trap cropping system provided an economic return per acre that exceeded that of the conventionally managed fields. In 1992, the central trap rows were omitted and traps were planted on the field margins only and the number of farmer cooperators was expanded to six.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $35,455: $16,711 in 1991; $18,744 in 1992.
Matching: $35,455

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

North Dakota State University, $19,455, ($35,455)
Producers, $16,000, ($35,455)

LNC91-33: LISA AS APPLIED TO VEGETABLE PRODUCTION SYSTEMS

Major Participants:

Ohio State University: Mark Bennett (Project Coordinator), Extension Specialist/Vegetable Crops, Horticulture Department, Howlett Hall, 2001 Fyffe Court, Columbus, OH 43210, Phone: (614) 292-6446. Marv Batte, Department of Agricultural Economics and Rural Sociology; John Cardina, Agronomy Department; Jeff Dickenson, OSU Sustainable Agriculture Program; Mac Riedel, Plant Pathology Department; Ken Scaife, Farm Manager, Horticulture Research Unit, OSU Horticulture Farm; Celeste Welty, Integrated Pest Management vegetable specialist, Entomology Department; Randall Wood, Agricultural Engineering Department; Nancy Creamer, graduate research associate, Department of Horticulture.

Ohio Ecological Food and Farming Association: Dave Baldock, President.

Ohio Department of Agriculture: Fred L. Dailey, Director; Jon Cherniss, Farm Manager, Ohio Department of Agriculture Sustainable Agriculture Demonstration Farm.

Cooperators:

Extension: Ron Overmyer, Extension Agent, Wood County.

Farmer Participants:

Paul Blausey, Ottawa County; Rex Detling, Darke County; John Hirzel, Farm Manager, Hirzel Farms.

Overview

Conventional agricultural practices have led to many economic and ecological problems including soil erosion, contamination of water and soil resources with pesticides and nitrates, lack of economic stability for farmers and an overdependence on fossil fuel. In this project researchers addressed environmental means of reducing reliance on off-farm purchased inputs, reducing soil erosion, adding organic matter to soils, minimizing environmental contamination and optimizing profits. They investigated cover crop use and management from a whole-farm perspective.

Objectives

1. Evaluate the suitability of various cover crops and combinations of cover crops for use in production systems for Midwestern conditions.

2. Determine appropriate combinations of cover crops to take advantage of beneficial species interactions.

3. Compare weed suppression characteristics of the various combinations of cover crops, and evaluate non-chemical methods of managing cover crops to maximize weed suppression and minimize soil erosion.

4. Measure the impact of diseases and insects on tomato crops in cover crop systems.

5. Evaluate the performance of tomatoes when planted into a killed cover crop mulch.

6. Conduct economic analyses on the most promising management systems.

7. Disseminate results through extension and outreach.

Results

In fall 1991, 18 cover crop mixtures (four species per mixture) were seeded at seven locations. Five of the mixtures were seeded at two different planting dates. The cover crop mixtures were evaluated for quick establishment, adequate ground cover for erosion control, winter hardiness, significant nitrogen contribution for subsequent crops, minimal immobilization of nitrogen after cover crop kill (C:N ratios), ease of killing by mechanical means, and weed control potential. Some of the sites were dropped from evaluation due to problems such as deer damage, and herbicide carryover (which inhibited germination of legumes).

The USDA Soil Conservation Service recommends a 30% ground cover to adequately control soil erosion. All of the mixtures at one site achieved this by one month after planting. At another site, only four of the mixtures had attained a 30% ground cover one month after planting, most likely due to inadequate soil moisture and high weed pressures. Results of the first year's research indicated there were no significant differences in above ground biomass between early and late planted mixtures at most sites. Three of the mixtures planted at the later dates had significantly higher carbon:nitrogen ratios than their earlier planted counterparts. This was probably because the legumes did not establish as well when planted later in the season. All of the treatments appeared to accumulate enough nitrogen in the above ground biomass to meet the needs of tomatoes, however, this study did not look at nitrogen fertilizer equivalencies of the cover crop nitrogen.

Whether a species was killed seemed to depend predominately on growth stage. Species that were in mid-to-late bloom or beyond (rye, hairy vetch, bigflower vetch, crimson clover, barley, wheat, and subterranean clover) were easily killed. Biomass accumulation at the time of undercutting may have also played a role. Species with more biomass may not have been able to adequately regenerate roots and supply enough water and nutrients for the plant to recover.

Rye was in all but two of the treatments that controlled the weeds best at two sites. In 10 out the 14 cases, rye made up over 85% of the mixture. There did not appear to be any additional trends with regard to species.

Many of the mixtures did quite well in this study based on the criteria used for evaluation. Some of the species, however, did not contribute significantly to the composition of the mixtures, or were not particularly suited to this type of production system. The four species which appeared to be best suited because they were adequately competitive and performed well in a mixture, overwintered, established quickly, were easily killed, and produced adequate biomass were rye, hairy vetch, crimson clover, and barley. All of these species have been shown to be allelopathic to some weeds. Additional screening should be done with this mix of species to determine its weed control potential and appropriate seeding rates and planting dates for optimizing other benefits.

Subsequent research will determine how tomatoes perform in the killed cover crop mulch. Tomato yield, maturity and quality, weed incidence, nitrogen availability, disease and insect prevalence, soil moistures and temperatures, and economic viability will be evaluated.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $77,279: $40,176 the first year; $37,103 the second year
Matching: $78,659

The following groups received funds and provided maching funds (as indicated by the figures in parentheses):

Ohio State University Research Foundation, $72,261, ($76,716);
Ohio Ecological Food and Farming Association, $2,040, ($408); and
Ohio Department of Agriculture, $2,978, ($1,535).

LNC91-34: STRIP CROPPING SYSTEMS TO REDUCE ENERGY INPUTS AND OPTIMIZE PROFITABILITY

Major Participants:

University of Minnesota: Gyles W. Randall (Project Coordinator), Soil Scientist, Southern Experiment Station, Waseca, MN 56093, Phone: (507) 835-3620. David D. Walgenbach, Integrated Pest Management, Entomology. Orvin C. Burnside, Weed Science, Department of Agronomy & Plant Genetics, St. Paul, MN 55108; R. Kent Crookston, Crop Physiology & Management, Dept. of Agronomy & Plant Genetics; Kent D. Olson, Agricultural and Applied Economics; Michael P. Russelle, Soil Science; Ward C. Stienstra, Extension Plant Pathologist, Plant Pathology.

Cooperators:

Minnesota Extension Service: Kendall Langseth, Freeborn County Extension Agent.

USDA/Soil Conservation Service: Mark A. Kulig, District Conservationist, Albert Lea, MN.

Albert Lea Technical College: Norm Fredin, Instructor, Farm Business Management.

Sustainable Farming Association of Minnesota: Brian Schutz, Chairman, Southern Chapter.

Southern Minnesota, Northern Iowa Ridge Tillers Association: Richard Thorson, President/Farmer; Tom Butler, Farmer, Blooming Prairie, MN.

Fleischer Manufacturing, Inc.: Keith Baleker, Buffalo Farm Equipment.

Farmer Participants:

Lynn Sorensen, Twin Cedar Farms, RR 2, Box 113, Alden, MN 56009.

Overview

Four single-crop production components (ridge tillage; three-crop wheat-corn-soybean rotation; narrow, alternate strips; and legume interseeding) were integrated into a complete cropping system that should reduce soil erosion, fertilizer nitrogen, pesticide and energy inputs, allow greater crop selection flexibility, reduce potential nematode, weed and insect incidence, and increase crop yield, land use efficiency and profitability.

Ridge tillage should reduce energy (fuel and labor) inputs and soil erosion. The wheat-corn-soybean rotation with interseeded legumes will reduce fertilizer nitrogen and pesticide input by interrupting weed, nematode and insect cycles normally associated with monoculture or traditional corn-soybean sequences. The narrow alternate strips of wheat along with ridge tillage should enhance wildlife (pheasant) habitat, adding to the aesthetic and recreational dimension of this cropping system. The narrow strips should produce higher yields due to the border effect. Energy use for artificial drying of corn should be reduced because of faster field dry down when in narrow strips. The goal of this project is to develop a cropping system that requires fewer off-farm purchased inputs, shows greater profitability, and demonstrates improved environmental impact.

This research project will integrate four single-crop production components (ridge tillage, three-crop wheat-corn-soybean rotation, narrow (15') alternate strips, and interseeding of annual legumes into wheat) into a complete crop production system. This cropping system should reduce soil erosion, nitrogen fertilizer, pesticide and energy inputs, allow greater crop selection flexibility, reduce potential soybean cyst nematode and corn rootworm incidence, increase crop yields and land use efficiency and increase profitability.

Objectives

1. Determine the production and economic impact of wheat introduced into a conventional corn-soybean alternate strip rotation in a ridge tillage system.

2. Determine the potential of this three-crop rotation to minimize insect, nematode and weed pressures and thus reduce pesticide use. Sub-objectives include monitoring the incidence of SCN, Northern corn rootworm, European corn borer, Brown Stem Rot, foliar diseases and weed species and determining their relationship to two-versus-three crop rotations. Knowledge of these disease, insect and weed relationships and the development of appropriate integrated pest

management (IPM) procedures could have tremendous future economic and environmental impacts in the Midwest.

3. Determine the effect of interseeding legumes with wheat on the potential fertilizer nitrogen savings, nitrogen availability to corn and economics in a ridge tillage system.

4. Measure the border row versus inside row effects of each crop on yield, pest incidence, nitrogen utilization, land utilization and production economics.

5. Evaluate the ability of potential soil tests to predict available soil nitrogen for corn following soybeans and following wheat with and without interseeded legumes.

Results

The rotations (continuous corn, corn-soybean, wheat-corn-soybean where the wheat is interseeded with either Nitro alfalfa, vetch, or nothing) were set up last year on a Webster clay loam (Typic Haplaquoll) on the Lynn Sorenson farm in Freeborn County. The whole field had been planted to soybeans in 1990. Yields and grain moisture of wheat, corn and soybeans were taken to evaluate the border versus inside row effects of the strips. Data on vetch and alfalfa yields, weed seedbank counts, root ratings and lodging to evaluate corn rootworms, tunnel counts to assess European corn borer damage, and soybean cyst nematode egg counts were taken to establish baseline data for the study.

Yield data obtained in this setup year, based on the assumption that the center two rows of a six-row strip or the center 5' of a 15' wheat strip represent a "whole-field" yield, showed:

1) 18% higher corn yields and 8% lower soybean yields compared to a "whole-field" average when grown in alternate strips, and

2) 16% higher corn yields, 2% higher wheat grain yield, 11% higher wheat straw yield, and 0% change in soybean yield when grown in the three-crop strip rotation compared to a "whole-field".

An evaluation of the pest situation showed: 1) little evidence of corn rootworm or European corn borer activity; 2) small weed seedbank numbers; 3) evidence of increased grass development after wheat, and 4) a substantial infestation of soybean cyst nematode. Vetch and alfalfa growth was limited in the fall but was more hearty in spring 1992. All crops were planted in the respective rotations in spring 1993. Rates of 0, 40, 80, and 120 lb nitrogen per acre were applied to corn after soybean and wheat, wheat plus vetch, and wheat plus alfalfa to determine the nitrogen credit due to fixation by the legumes. Reduced rates of herbicides were band applied to both corn and soybean with no pesticide applied to wheat. Mechanical weed control and ridge building were accomplished through cultivation.

In summary, the rotations have now been established and the experiment is progressing.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $53,000: $25,600 in 1992; $27,400 in 1993
Matching: $111,250

LNC91-35: IMPROVING THE ECOLOGY OF CORN PRODUCTION AND TESTING PERENNIAL ALTERNATIVES TO SILAGE CORN

(Revised May 31, 1993)

Major Participants:

Michael Fields Agricultural Institute: Walter Goldstein (Project Coordinator), Agronomist, 3287 Main Street, East Troy, WI 53120, Phone: (414) 642-3303. John Hall, Agronomist.

Nebraska Sustainable Agriculture Society: Sam Welsch, Executive Director; Tom Tomas, Hartington.

University of Illinois: Gary Heichel, Department Head, Agronomy; Emerson Nafziger, Corn Agronomist, Urbana.

Ohio State University: Fred Miller, Department Chairman; Peter Thomison, Corn Agronomist, Columbus.

University of Wisconsin, Madison: R.E. Doersch, Chairman, Agronomy Department; Ken Albrecht, Forage Specialist; Paul Carter, Corn Agronomist.

Cooperators:

University of Wisconsin, Madison: J. Coors.

University of Nebraska, Lincoln: W. Compton.

Pioneer International: D. Flowerday, Lincoln, NE.; T. Kevern, Janesville, WI.

Iowa State University, Ames: A. Hallauer.

Hoegemeyer Hybrids: T. Hoegemeyer, Hooper, NE.

Illinois Foundation Seed: W. Shank, Seward, NE.

Farmer Participants:

John Bashaw, East Troy, WI (corn/cover crop and clover trials); Mike Herman, Marquette, NE (corn varieties/cover crops); Bernie Kleiber, Whitewater, WI (clover management); Allan Wood, Elkhorn, WI (corn varieties/cover crops).

Overview

Corn is a major crop of the Midwest but its culture causes erosion and pollution with agrichemicals. The overall goal of our project is to improve the ecology of corn production and to test replacing silage corn with perennial forages. To improve corn's ecology we will optimize its production together with companion cover crops. We will also optimize the management of clover crops for green manure before growing corn under ridge-till and conventional tillage

conditions. In addition, we will compare corn as a silage crop with some promising, high-yielding perennial forages that may improve the environmental effects and economics of forage production.

The results of the project could impact farms that grow corn in the Midwest, including farms with and without livestock. The results could lead to greater ecological and financial sustainability.

Objectives and Rationale

1. To optimize corn-cover crop systems and to evaluate the effects of corn-cover crop systems on corn yields, soil structure and yields of following crops.

Growing corn together with cover crops can (a) provide a ground cover after the corn is harvested, thus reducing erosion; (b) build soil structure and fix N; (c) reduce nitrate losses due to leaching; (d) suppress late germinating weeds; and (e) possibly provide some grazing after the corn is harvested.

In south Wisconsin, three years of replicated, on-farm trials have been carried out by farmers in conjunction with Michael Fields Agricultural Institute (MFAI) in corn. The most reliable cover crops have proved to be large seeded (vetch, rye grass, radish). Broadcasting cover crops into corn at last cultivation or at dry-down did not give reliable cover crops. Drilling these cover-crops into corn with a modified drill when the corn was 9-14 inches tall gave reliable cover crops, apparently without reducing corn yields.

However, when corn populations are too dense, cover crops do poorly due to lack of light. We will ascertain the relationships between corn populations, light incidence and cover crop production in field trials. Optimizing the corn/cover crop system may imply finding those varieties of corn that will yield well when grown at lower populations than are presently recommended. Such "flexible-ear" or "prolific" varieties have been identified by public corn scientists and private corn breeders in different regions of the corn-belt. Also, "upright-leaf" hybrids might be useful because they allow more light through the canopy than plants possessing a normal, lax-leaf architecture. We will test some of these corn varieties in cover crop systems in four different corn production regions to ascertain the potential benefits and drawbacks of corn-cover crop systems.

2. To optimize management of green-manure clover crops for conventional-till and ridge-till corn production.

Low-input farmers in the Midwest often grow sweetclover under a crop of wheat or oats and turn it under in the spring before growing corn. At question is how to best utilize the clover and its nitrogen supplying potential, while reducing erosion potential and costs associated with tillage. Ridge-till farmers are often interested in utilizing green manures in their rotations but they do not want to incorporate them with tillage. We will examine alternative ways to kill clover that aerate the soil (fall chiseling with a subsoiler that gives minimal surface disturbance) but keep it covered with residue (mowing or use of sweeps) both on a conventional tillage and ridge-till farm.

Sweetclover can be killed in the spring if it is mowed after its crown buds have lost their dormancy and the lower stem nodes have lost their ability to grow. Extremely early yellow-

blossom sweetclover varieties might be well suited to early mow-kill as they grow vigorously in the spring and flower about 10-14 days earlier than any other varieties (late April, early May in Nebraska). We will find out the earliest stage of development in which we can kill clover by mowing.

Mowing or undercutting legumes instead of incorporating them in the soil reduces nitrate production and can reduce corn yields. By fall chiseling we hope to break up some roots and crowns and produce the nitrate needed for early planting of corn. The Australian chisel plow we are using provides minimal turning action and surface disturbance and thus has proved to be acceptable by some ridge-till farmers.

3. To test high-yielding perennial forages and polycultures as alternatives to silage corn.

Erosion, expenses and pollution associated with tillage, seed and herbicides might be spared if farmers could grow a perennial silage that produced yields similar to annual corn. In the USSR, a number of high-producing perennial forages are being used (*Silphium perfoliatum, Galega orientalis, Polygonum Weyrichi, Polygonum transbaikali*, and others). These crops produce high-quality forages with yields similar to or higher than silage corn. Though these crops have an unproductive year of establishment, high-yielding stands can be maintained for 8-15 years.

These forages have not, to our knowledge, been tested in the US, outside of initial trials with *Silphium perfoliatum* begun in Wisconsin at MFAI in 1989. *Silphium perfoliatum* is native to the Midwest and is commonly known as "cup-plant." It is a tall, leafy member of the sunflower family, and has the reputation of being one of the most aggressive of all prairie plants.

Trials with second year cup-plant stands in southern Wisconsin in 1990 indicate that cup-plant can be used in a two cut system. Dry matter yields were slightly lower than corn. Quality (measured as crude protein, acid detergent fiber, neutral detergent fiber) in the first and second cuts were similar to number one and prime grade alfalfa, respectively.

Results

Cover crops have been tested under corn in two sites in Wisconsin and Nebraska and one site in Ohio and Illinois. Trials included planting corn at low (16,000-18,000 plants/acre) or high (24,000-26,000 plants/acre) rates and split plots with or without cover crops. Testing involved eight common corn hybrid varieties and cover crops of hairy vetch, annual ryegrass and oil radish.

Cover crops did best on five medium and low yield sites where average corn yields ranged from 63 to 131 bushels/acre. Lowering the seeding rate of corn strongly increased the growth of cover crops from 1.3 to 3.7 times that achieved at the high rate. Cover crop yields ranged from 0 to 3,247 lbs/acre. Cover crops increased the grain yield of corn 5% on one site. The most upright leafed hybrid was not associated with especially high yields of cover crops. High populations of corn only caused grain yield increases on the two sites that both showed high average yields of 166 bushels per acre. Rate of weeding trials are presently being conducted with several prolific hybrids to ascertain relationships between population, cover crop yield, and prolificacy.

Trials have also been established to evaluate the most ecological and economical methods for killing sweetclover before corn and the use of two perennials -- cup plant and galega -- used in Russia for forage production. Establishment methods for cup plant were tested and it appears seed viability decreases strongly with age of seed and that transplanting divided rhizomes can be a highly successful method for establishment. An article in a popular farm magazine generated about 800 requests from farmers and researchers who wanted more information or to help with research on the cup plant.

Project duration: Two years, ending Aug. 31, 1993
Funding: $92,000: $46,000 the first year; $46,000 the second year.
Matching: $71,180.

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Michael Fields Agriculture Institute, $60,800, ($33,800);
Northeast Sustainable Agriculture Society, $6,000, ($2,200);
University of Illinois, $8,500, ($11,430);
The Ohio State University, $8,700, ($13,750); and
University of Wisconsin, $8,000, ($10,000).

LNC91-36: DEMONSTRATION OF LIVESTOCK GRAZING AS AN ALTERNATIVE TO ROW CROPS ON HIGHLY ERODIBLE LAND FOLLOWING CRP CONTRACTS

Major Participants:

Southern Iowa Forage and Livestock Committee (SIFLC): Jim Hoffman (Project Coordinator), Vice Chairman, 701 Davis Avenue, Corning, IA 50841, Phone: (515) 322-3101. Norvell Houck, Chairman, Farmer/Cattleman, Rt. 3, Corning, IA 50841. James W. Hoffman, Vice Chairman, Cattleman, Okey Vernon First National Bank, 701 Davis Avenue, Corning, IA 50841.

Iowa State University: Stephen K. Barnhart, Agronomy Department, Forage Specialist, 2104 Agronomy Hall, Ames, IA 50011. Daryl R. Strohbehn, Animal Science Department, 109 Kildee Hall.

Extension: Chris D. Nelson, Adams County Agriculturist, ISU Extension, 7th and Nodaway Street, Corning, IA 50841; Stan Murdock, Southwest Iowa Area Extension Office, Hwy 71 South, P.O. Box 460, Atlantic, IA 50022.

USDA/SCS: Brian C. Peterson, District Conservationist, 625 Benton Avenue, Corning, IA 50841.

Farmer Participant:

Juanita Cooley, RR #3, Corning, IA 50841.

Overview

Adams County is located in Southwest Iowa. There are 30,948 acres currently enrolled in the USDA Conservation Reserve Program (CRP). These acres comprise approximately 20% of the Highly Erodible Land (HEL) in the county. The landscape is rolling with loess covered ridges, steep sidehills with glacial till and paleosol soils and small creek bottoms. Approximately one-third of Adams County consists of these glacial till and paleosol soils. This particular combination of terrain and soil makeup is common to a much larger area which includes southern Iowa and northern Missouri.

Land use in this area has changed dramatically since 1960, when pasture and hay land comprised 64% of the farmland. By 1985, this figure had dropped to 40%. During this same 25-year period, row crop acres increased by 25% as many "permanent pastures" were plowed and brought into row crop production.

This study deals with the management of steep sidehills in long-term forage production with cattle or sheep so those farmers will have profitable farming operations. This problem is an environmental issue as well as an economic issue. Land in pasture and/or hay will have less soil erosion and less chemical and fertilizer runoff than land in row crop.

Demonstrating improved grassland management is one way to help solve this management problem. Accomplishing the goal of more profitable grazing operations would add much to the economic development of not only Adams County. Other areas of the country, especially those with similar topography, soil resources and patterns of land use, could realize similar benefits from profitable grazing operations.

Objectives

1. Demonstrate the economic feasibility of rotational grazing and short duration rotational grazing.

2. Demonstrate the effectiveness of a contour lane for moving livestock in a rotational grazing system to reduce the potential for gully erosion from cattle paths going up and down hill.

3. Demonstrate the effectiveness of modern "New Zealand style" electric fences in a planned grazing system.

4. Develop a computerized data base for 100 existing CRP contracts in Adams and neighboring counties that will describe predominant soil types, type of vegetation, quality of existing fences, type and quality of existing water sources, and ownership characteristics.

This demonstration project will involve a very basic form of sustainable agriculture, that being permanent pastures utilized by grazing animals. We plan to show that with proper management, grazing livestock can be competitive with a more high-input row crop system on steep marginal land.

By using information gained in the grazing demonstration and combining it with information in the CRP data base, strategies can be developed to convert CRP acres to pasture

and hayland instead of cropland at the end of the CRP contract. As previously mentioned, this would be beneficial in terms of economic as well as environmental considerations in the area.

Project Duration: Two years: September 1, 1991 to August 31, 1993
Funding: $40,340: $24,040 the first year; $16,300 the second year
Matching: $33,800

Southern Iowa Forage and Livestock Committee

LNC91-37: COMPARATIVE ECONOMIC AND ECOLOGICAL ANALYSES OF LOWER CHEMICAL INPUT FRUIT FARMS AND OTHER FRUIT FARMING SYSTEMS

Major Participants:

Stratford Ecological Center: Jeff Dickinson (Project Coordinator), 5353 Williams Road, Ashville, OH 43103. Kamyar Enshayan, Education Coordinator, Farmer-to-Farmer Mentorship Program.

Ohio State University: Clive Edwards, Sustainable Agriculture Program, Entomology, Columbus, OH 43210. Richard Funt, Horticulture; John Blair, Entomology, Senior Researcher; Marvin Batte, Agricultural Economics; Celeste Welty, Entomology, Integrated Pest Management; Mike Ellis, Plant Pathology.

Ohio Ecological Food and Farm Association: Philip Hale, On-Farm Tour Coordinator, 549 W. Main Street, Wilmington, OH 45177. Mike Laughlin, Certification Manager, 140 Garden Rd., Columbus, OH 43214.

Ohio Department of Agriculture: Jon Cherniss, Farm Manager, Ohio State University Demonstration Farm, Sustainable Agriculture Program, 1735 Neil Avenue, Columbus, OH 43210.

Overview

This is a two-year multidisciplinary study to conduct economic and ecological analyses of three established, family-operated, lower-chemical-input fruit farming systems. These three fruit farms, including 1) the Beam Road Berry Farm in Crestline, OH, operated by Ken and Lyn Chapis, 2) Silver Creek Farm in Hiram, OH, operated by Ted and Molly Bartlett, and 3) an apple orchard in Chagrin Falls, OH, operated by Elbert Crary, are located in northeastern and central Ohio and are representative of similar lower-chemical-input fruit production operations in the Great Lakes Region.

Economic analyses will involve developing detailed records of all inputs and outputs for each fruit farming system. Ecological analyses will involve developing whole-farm nutrient budgets and evaluating in-field ecological processes. Interrelationships between economic and

ecological data will be evaluated. Economic and ecological comparisons will be made between these farms and higher-chemical-input fruit production systems that already have been documented for similar crops in the region.

Objectives

1. Make detailed whole-farm economic analyses of low-chemical-input fruit farms, growing tree fruits and small fruits, for economic comparison with conventional and other fruit farming systems with similar crops in the same region.

2. Make detailed ecological analyses of the same low-chemical-input fruit farms for ecological comparisons with other fruit farming systems.

3. Disseminate information from these on-farm studies through Field Days, Demonstrations/Workshops, a Farmer-to-Farmer Mentorship Program and printed information.

4. Develop long-term demonstrations of lower-chemical-input fruit farming systems for continued economic and ecological evaluation and for ongoing display and education for fruit farmers and the general public.

Results

Six production sites are being used to evaluate the economics of sustainable ground fruit production. Economic analyses has already begun and ecological analyses will begin this year with three ground fruit production systems -- strawberries, brambles (red raspberries) and blueberries. During the first year of the study, samples were taken for nutrient analysis and arthropod, pest and disease communities. To reinforce the farm studies, an organic, integrated lower chemical input and a high chemical input system are being evaluated for raspberry and strawberry production at the Ohio Department of Agriculture/Ohio State University Demonstration Farm in Reynoldsburg, Ohio. These systems are being evaluated economically and compared on a long-term basis for nutrients, pest monitoring and climate data.

Questionnaires and interviews with producers were used to gather information about production in past years. A second demonstration of sustainable fruit production began at the Stratford Ecological Center, with a small planting of strawberries in 1992, with additional tree and ground fruits planned to be planted in 1993. Preliminary results show the influence of different kinds of mulches on soil moisture, weed populations and nutrient status, which then affect insect and microbial populations. Nutrients in manures, compost and other soil and foliar amendments are being analyzed from the first year's samples.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $110,610: $55,305 the first year; $55,305 the second year
Matching: $146,698

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Stratford Ecological Center, $66,500, ($42,080);
The Ohio State University, $34,400, $100,478; and
Ohio Ecological Food and Farm Association, $9,710, ($4,140).

LNC91-38: PLANNED GRAZING SYSTEMS FOR SUSTAINABLE LIVESTOCK PRODUCTION

Major Participants:

University of Missouri: James R. Gerrish (Project Coordinator), Research Assistant Professor, Forage Systems Research Center, Columbia, MO 65211, Phone: (314) 882-2121. R. David Hammer, Soil Science; Fredric A. Martz, Animal Science; Ronald E. Morrow, Animal Science; Donald Osburn, Agricultural Economics.

USDA/Soil Conservation Service: Maurice Davis, State Range Conservationist and Grassland Specialist; Patrick Wolf, Deputy State Conservationist.

Missouri Department of Conservation: Steve Clubine, Grassland Biologist; Bill McGuire, Wildlife Services Supervisor.

US Forest Service: Janette Kaiser, District Ranger.

Farmer Participants:

Green Hills Farm Project: Dennis McDonald, cow/calf producer, Grundy County, MO; David Schafer and Alice Dobbs, purebred cow/calf and sheep producers, Grundy County, MO; Eric Woodard, cow/calf producer and backgrounder, Grundy County, MO.

Overview

This is a four-phase project integrating research and education relevant to planned grazing systems. A planned grazing system is a pasture management system in which there are at least three pastures with clearly defined grazing and non-grazing periods based upon the physiological needs of the pasture plants and nutritional requirements of the grazing livestock. Previous research at the University of Missouri has shown the potential of planned grazing systems for significantly lowering the cost of beef production and enhancing farm profitability.

The project used a whole-farm setting to study pasture productivity and persistence, cow-calf and stocker performance and mineral cycling under three grazing management systems differing in stock density and paddock number and configuration. Three, twelve and twenty-four paddock systems were compared. Within each grazing regime there were replicate sets of pastures with either lane access to water or water available in every paddock. Water availability in every paddock should reduce animal travel time and thereby lower maintenance requirements, minimize development of soil erosion sites along animal trafficways and result in more even manure redistribution thereby lowering the need for purchased fertilizer.

Objectives

1. Evaluate planned grazing systems differing in level of capital and management input in terms of soil and plant community stability, livestock performance and farm profitability.

(a) Determine efficiency of soil nutrient recycling under three grazing management systems with differing stock densities and paddock configurations.

(b) Determine persistence and productivity of perennial legumes in three grazing management systems.

(c) Evaluate systems for optimizing the utilization of stockpiled tall fescue as a winter forage substitute for harvested feedstuffs.

2. Develop demonstration sites for planned grazing systems on both publicly and privately owned land.

3. Provide intensive training workshops on planned grazing systems for public agency personnel who provide an existing educational network to disseminate technical information to producers throughout the region.

4. Provide intensive training workshops on planned grazing systems to producers.

Results

This is the first year of a four-phase project integrating research and education relevant to planned grazing systems. A planned grazing system is a pasture management system which uses a minimum of three pastures with clearly defined grazing and non-grazing periods based on the physiological needs of the pasture plants and nutritional requirements of the grazing livestock. Advantages are that it can significantly lower the cost of beef production and enhance farm profitability. The research objectives are to investigate, in a whole-farm setting, pasture productivity and persistence, cow-calf and stocker performance, and mineral cycling under three grazing management systems differing in stock density and paddock number and configuration. Three, twelve, and twenty-four paddock systems are being compared. Within each grazing regime there will be replicate sets of pastures. Water availability in every paddock should reduce animal travel time and thereby lower maintenance requirements, minimize development of soil erosion sites along animal trafficways, and result in a more even manure redistribution thereby lowering the need for purchased fertilizer. Base line data on soil structure and fertility has been collected during this reporting period.

The second objective is to develop demonstration sites for planned grazing systems on both publicly and privately owned land. The public demonstration sites are being managed jointly by University of Missouri AES scientists, Soil Conservation Service (SCS), and Missouri Department of Conservation (MDC). Demonstration of grazing systems which are profitable, soil conserving, and hospitable to wildlife is the goal of this program. Field days and/or special tours were held at each location and several tours and field days are planned for 1993. Twenty-six on-farm educational events are planned for private lands demonstration sites statewide.

Education of public agency field staff in planning and management of planned grazing systems is the third objective. An intensive two-day in-service training workshop was held for about 50 Cooperative Extension area and state specialists. A series of videos explaining various aspects of grazing management is being developed for distribution to County Extension Centers, SCS Field Offices, and the general public.

Direct education of producers is the final goal of this project. Three three-day grazing management workshops are being conducted for producers (47 people attended each of the first two sessions). Tours of private farms that have already successfully implemented planned grazing systems are included in the workshops and experienced producers served as instructors for portions of these workshops.

The economic impact of adopting planned grazing systems on a widespread basis is significant and could result in substantial reduction in the production cost of beef, dairy and sheep production. Based on the results of an earlier four-year grazing systems research project conducted at the University of Missouri - Forage Systems Research Center, a potential increase in net farm return in the beef sector was estimated at $52,000,000 assuming a 20% producer acceptance rate with an increase in profit per acre at 33% of that reported in the earlier University of Missouri research. As most of the profit increase is realized from reductions in input costs and improved efficiency of land use, this economic benefit would be more consistent than higher profits based on increased production levels.

The environmental impact of adopting planned grazing systems on a widespread scale also would be substantial. Using legumes as the primary nitrogen source in pasture systems would greatly reduce the application of nitrogen fertilizers to much of the steep, highly erodible pasture lands in Missouri and other parts of the United States. More uniform distribution of grazing and minimization of nutrient loading at points of animal congregation would also reduce nutrient runoff potential and make more efficient use of in situ soil nutrients. Maintenance of improved vegetative cover on highly erosive pasturelands should reduce soil erosion from grasslands and improve the quality of surface runoff. Actual surface runoff should be reduced with more complete vegetative cover and greater mean height of the plant community.

Project Duration: Two years, ending August 31, 1993
Funding: $142,576: $80,459 the first year; $62,117 the second year
Matching: $142,576

LNC91-39: A LANDSCAPE ECOLOGICAL PERSPECTIVE ON INSECT AND WEED POPULATION REGULATION IN LOW-INPUT AND CONVENTIONAL SYSTEMS

Major Participants:

Michigan State University: Douglas A. Landis (Project Coordinator), Field Crop Entomology, Population Sampling and Landscape Ecological Analysis, 104 B Pesticide Research Center, East Lansing, MI 48824, Phone: (517) 355-1855. Katherine L. Gross, Plant Ecology, Weed Population Biology, Kellogg Biological Station, Hickory Corners, MI 49060.

Farmer Participants:

Robert and JoAnn Fogg, organic crop and dairy farmers, 3043 Olds Road, Leslie, MI 49251. The Fogg farm was certified organic in 1989.

Overview

While research in the area of sustainable agriculture is growing exponentially, there is a critical lack of understanding of how these production regimes function as ecosystems. Without this ecological framework, our ability to predict how these systems will perform under differing environmental conditions is minimal, making it difficult to reliably transfer technology from one farm to another. In addition, without a sound ecological grounding, we have difficulty directing the transition process with confidence. Conventional agricultural systems have through the use of intensive chemical, energy and nutrient inputs effectively substituted for the biotic regulation and nutrient cycling which occurs in, and serves to sustain, unmanaged ecosystems. As agriculture is faced with reducing reliance on chemical inputs, the incorporation of more biotic regulation into these systems is clearly needed. The emerging discipline of landscape ecology provides a novel body of theory and set of tools by which to better understand and predict biotic regulation in low-input agricultural systems.

This project examines insect and weed population regulating factors in low-input and conventional farming systems in relation to farm landscape structure. Techniques adapted from landscape ecology will be used to assess landscape structure under the two systems. Structural elements in the agricultural landscape will then be examined to determine their impact on weed and insect biotic regulation. Understanding the effect of farm-level landscape structure on pest and natural enemy population dynamics is a vital first step in the design of sustainable farming systems in which the synergistic interaction of biological and cultural control can be realized.

Objectives

1. Characterize landscape structure of an established low-input dairy/crop farm compared to nearby conventional farms. For this study, landscape refers to the aggregate structure of the landforms that exist in an area, including the topography, soil types, drainage patterns, plant communities, human communities and climate. The discipline of landscape ecology stresses that the structure of landscape features is critical in regulating ecosystem dynamics. For example, soil type, climate and topography in any given area determine to a large degree the type of plant and animal communities which occur there. The Robert and JoAnn Fogg farm in Leslie, MI represents an established low-input dairy/crop farming system. Contrasting this farm and nearby conventionally managed systems represents a unique opportunity to utilize a landscape ecology approach to characterize the interactions between pests (weeds and insects), natural enemies, cropping practices and the environment.

2. Contrast insect population regulation in low-input and conventional cropping systems in relation to farm landscape structure. Insects and their natural enemies respond to farm-level landscape structure. The degree of pest population regulation that biological control agents achieve may be directly related to the physical structure of the farm landscape. We propose using European corn borer (ECB) *Ostrinia nubilalis* Hübner as the model insect for this study. The ECB was selected, in part, because of interactions with the weed ecology aspects of this study.

3. Characterize weed population regulation and distribution in relation to landscape structure. Changes in landscape structure and management practices associated with low-input systems have dramatic effects on weed species composition, abundance and distribution. However, the causes of these shifts remain largely unexplored. The influence of field edge

communities on weed species composition in corn will be compared. In addition, the factors affecting weed abundance and distributions within these fields also will be studied.

Results

Preliminary results of this study show how the structure of the agricultural landscape can play an important role in determining the effectiveness of natural enemies to common agricultural pests. This study is examining the effect of field size, shape, type of crop, field border composition, and the distance to alternative habitats etc. on the biological control of insects and weeds. Eriborus wasps, one of the most important parasites of the European corn borer in the Midwest, were found to feed on lambs quarter in corn fields and were found to be affected by the agricultural landscape. Further testing will examine exactly how the landscape affects their efficiency and lifespan (in some landscapes they may just survive two days while in others they may live two to three weeks, significantly opening the window of potential control).

Studies of weed seed predation showed that during the winter, vertebrates removed 6-12 percent of the seeds on the soil surface of crop fields in a six-day period. In the spring, insects and vertebrates removed 48.5% of the seeds within 5 meters of hedgerow and 35% at 100 meters from a hedgerow in a six-week period. Carabid beetles were the most abundant insect seed predator and rodents and birds the primary vertebrate seed feeders. These studies demonstrate that landscape structure can play an important role in determining the effectiveness of natural enemies.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $75,000: $37,500 in 1991; $37,500 in 1992
Matching: $40,593

LNC91-40: PARTICIPATORY RESEARCH AND EDUCATION NETWORK FOR SUSTAINABLE AGRICULTURE IN ILLINOIS

Major Participants:

University of Illinois: John M. Gerber (Project Coordinator), UI Agro-Ecology Program, College of Agriculture, 211 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL 61801, Phone: (217) 244-4232.

Illinois Stewardship Alliance: Kate Duesterberg, Coordinator of Agricultural Programs, 116½ W. Cherry, Herrin, IL 62948.

Illinois Sustainable Agriculture Society: Nick Robertson, President, RR 1, Box 172, Cowden, IL 62422.

Southeastern Illinois Sustainable Agriculture Association: Tom Hortin, President, Rt. 1, Box 254, Albion, IL 62806.

Overview

This project will establish a network among three farmer-managed, community-based sustainable agriculture organizations in Illinois and the University of Illinois. The purpose of the network will be to conduct on-farm participatory research and education projects to evaluate and promote low-input sustainable farming practices.

Educational projects will be designed by the participants to provide practical information that can be easily interpreted and used by farmers. Educational meetings, demonstrations and field tours will involve farmers, the UI Cooperative Extension Service, the Soil Conservation Service, Soil and Water Conservation Districts, the media and agri-business interests in the community.

On-farm research projects will be designed by farmers in cooperation with university research scientists. Field studies will be quantitatively evaluated using formal statistical procedures. The paired-comparison model adopted by the Practical Farmers of Iowa provides an example of a statistically valid field study design.

Specific research and/or educational projects will be selected by farmer-cooperators during the participatory process, but will focus on: 1) nitrogen fertilizer reduction on corn; 2) reduced herbicide usage on soybeans in conservation tillage systems; and 3) tillage and rotation system impact on soil tilth and root growth.

Objectives

(1) Develop economically competitive and sustainable farming systems through a scientifically valid on-farm participatory research program.

(2) Facilitate the adoption of sustainable technologies and practices by Illinois farmers through educational projects such as on-farm demonstrations, farm tours, workshops, publications, regional meetings and a farmer-to-farmer communication network.

(3) Develop the methodology and institutional capacity to conduct scientifically valid on-farm participatory research and educational projects in Illinois.

Results

Through this project a network was established among the University of Illinois, the Illinois Department of Agriculture Division of Natural Resources, and four farmer-managed, community-based sustainable agriculture organizations in Illinois. The network has begun to conduct on-farm participatory research and education projects to evaluate and promote low-input sustainable farming practices. Educational projects have and will continue to be designed by the participants to provide practical information that can be easily interpreted and used by farmers. Educational meetings, demonstrations and field tours have involved farmers, the University of Illinois Cooperative Extension Service, the Soil Conservation Service, Soil and Water Conservation Districts, the media, and agri-business interests in Illinois.

On-farm research projects have been designed by farmers in cooperation with university research scientists. Field studies will be quantitatively evaluated using formal statistical

procedures. Specific research and/or educational projects have been selected by farmer-cooperators using a participatory process. They focus primarily on: 1) nitrogen fertilizer reduction on corn; 2) reduced herbicide use on soybeans in conservation tillage systems; and 3) tillage and rotation system impact on soil tilth and root growth.

By providing for new communication paths among the major sustainable agriculture associations in Illinois and the University of Illinois, this program will help farmers develop and share new low-input sustainable practices which can be integrated into current farming systems with minimum disruption. Specifically, research and education projects will help farmers to reduce their reliance on off-farm inputs; enhance soil productivity; reduce soil erosion; minimize environmental contamination; and conserve natural resources. In addition, the Network will help facilitate technology adoption relative to low-input/sustainable farming systems. This will be accomplished through educational projects such as on-farm demonstrations, farm tours, workshops, publications, regional meetings and a sustainable agriculture communication network.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $110,500
Matching: $170,600

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Illinois, $110,500, ($41,600);
Illinois Stewardship Alliance, $0, ($63,000);
Illinois Sustainable Agri. Society, $0, ($30,000); and
Southeast Illinois Sustainable Agri. Association, $0, ($36,000).

LNC91-41: LEGUME MANAGEMENT RESEARCH FOR VA MYCORRHIZAL ENHANCEMENT IN POTATO PRODUCTION

Major Participants:

Michigan State University: George W. Bird and Gene R. Safir (Project Co-Coordinators), Department of Botany and Plant Pathology, East Lansing, MI 48824, Phone: (517) 355-1855. Dr. Bird is Professor of Nematology and is also in the Department of Entomology.

Michigan Potato Industry Commission: Ben Kudwa, Executive Director, 13109 Shavey #7, DeWitt, MI 48820.

Farmer Participants:

Butler Potato Farm: Jim Butler, 2688 Highway M69, Crystal Falls, MI 49920. This 450-acre farm grows potatoes, oats, rye, clover and sudax.

Kitchen Potato Farm: Bob and Bill Kitchen, Highway 131, Alba, MI 49611. This 2500-acre

farm grows potatoes and alfalfa.

Overview

Vesicular-arbuscular mycorrhizae (VAM) are beneficial fungi that colonize root tissue and function as symbionts. They are important in nutrient, water and plant health relationships, including alleviating infectious diseases of root tissue caused by pathogenic nematodes and fungi. It has recently been shown that diversity of VAM species and potential legume management strategies are important factors in enhancement of plant growth and plant health; and frequent use of agricultural land for a single commodity reduces diversity of indigenous VAM species, resulting in diminished potential for plant growth enhancement. For this project, potato (*Solanum tuberosum*) production has been selected to demonstrate that legume management enhances VAM and provides protection against pathogenic nematodes and soil-borne fungi. The project places special emphasis on non-N impacts of legume rotations.

Potato production is of major significance in the North Central Region. A major limiting factor in potato production is the joint action of the Penetrans Root-Lesion Nematode (*Pratylenchus penetrans*) and the Dahliae Wilt Fungus (*Verticillium dahliae*) resulting in a disease complex frequently referred to as Potato Early-Die (PED). Tuber yield losses to PED are often as high as 25-60%. PED is currently controlled primarily through the use of nematicides, and to a lesser extent with crop rotation.

There is a distinct need to develop improved procedures to protect *S. tuberosum* from PED in commercial agriculture. The proposed project consists of laboratory and field research, on-farm demonstrations and industry communications designed to show that specific legume management systems enhance colonization of *S. tuberosum* roots by VAM fungi, thereby increasing tolerance of *S. tuberosum* to *P. penetrans* and *V. dahliae*. Two commercial farms (Butler and Kitchen Potato Farms), the MI Potato Commission and the National Potato Council have significant roles in the project. Dr. G.W. Bird (nematologist) and Dr. Gene Safir (VAM specialist) will serve as Co-Principal Investigators.

Objectives

(1) Develop legume management systems designed to enhance *VAM* activity and sustain field-level potato production through protection against pathogenic nematodes and fungi.

(2) Use on-farm commercial potato production sites to demonstrate legume management to control pathogenic nematodes and fungi.

(3) Disseminate the results of the project to Michigan and US potato growers through the MI Potato Industry Commission and National Potato Council.

Results

Most of the studies described for the first research objective have been initiated. The 1992 crop rotation trials at the Kitchen and Butler Farms resulted in increased tuber quality and yield with increases in the length of the crop rotations. Rotations including Sudax resulted in tuber yield losses caused by the potato early-die Disease Complex. In preparation for the future outreach components, the project was presented to the Research Committee of the Michigan

Potato Industry Committee. Two graduate research assistants were hired for the project, one to coordinate the field and greenhouse components of the research and the other to manage the laboratory section of the research.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $96,000: $48,000 the first year; $48,000 the second year
Matching: $82,000

LNC92-42: REGIONAL WORKSHOP FOR EDUCATORS ON THE USE OF COVER CROPS IN SUSTAINABLE FARMING SYSTEMS

Major Participants:

Illinois Sustainable Agriculture Society: Nick Robertson (Project Coordinator)

Illinois Department of Agriculture: Michael Rahe, Sustainable Agricul ture Program

University of Illinois Agricultural Experiment Station: John M. Gerber, UI Agro-Ecology Program

Illinois Sustainable Agriculture Network: Deborah Cavanaugh-Grant, IDSN, On-farm R & E Coordinator

Overview

The primary objective of the project will be for farmers to educate Cooperative Extension agents, Soil Conservation Service staff, state Natural Resource personnel, and crop consultants on the practical use of cover crops in sustainable farming systems. Knowledge based on personal experience will be shared with agricultural professionals in a workshop format that includes both classroom and hands-on field activities. A second objective of the project is to identify research needs of the farming community and the educational needs of both farmers and scientists on the long-term effect of using cover crops in sustainable farming systems. The workshop format will help agricultural professionals gain a better understanding of the needs of farmers. In addition, the working relationship that develops within this farmer/scientist coalition should improve the interaction among these groups in the future.

Two workshops (field and classroom) on the use of cover crops in sustainable farming systems will be organized. Up to 80 Cooperative Extension Service, Soil Conservation Service, state Natural Resource personnel, crop consultants, and other educators and researchers will be invited to participate. The program will include instruction on current practices used by farmers and a farm-lab opportunity with hands-on experience and observation. The farm-lab experience will allow observations of soil profiles under various management regimes and instruction on the use of field instruments to evaluate soil properties. The farm-lab will be conducted on a working farm in southeastern Illinois. A winter workshop will review the observations made during the summer farm-lab. In addition, a discussion of sustainable agriculture issues and the identification of future research and educational needs will occur. A manual of resource materials on cover crops will be compiled for use in the workshops. This manual will be sent

to other states to assist in organizing similar workshops throughout the Midwest. It will also be used by the UI Cooperative Extension Service for in-service training programs.

The potential benefits of cover crops include; nitrogen fixation, reduced soil loss, improved soil tilth, and weed control. Potential problems are: crop yield losses due to late planting or competition; alternate hosts for pathogens; and the cost of establishment and management. These benefits and problems will be examined from both the farmer's and scientist's perspective in this project. This cooperative project between public agencies and a farmer-managed organization will provide a prototype for future educational programs on sustainable agriculture in Illinois. An educational environment in which farmers, university scientists, and government workers act as both learners and educators will be encouraged. Leadership of the project will be provided by the Illinois Sustainable Agriculture Society, with assistance from the public agencies. The dominant model for education is one in which university or government specialists assume the role of teacher-expert and farmers assume the role of student. These workshops will reverse this relationship, thus building toward an environment of co-learning and partnership. In an adult learning system the roles of students and teachers are not fixed, since students and teachers learn from each other. In order to demonstrate that the traditional teacher/student relationship can be changed, the subject matter chosen for this project is one in which farmers are the more knowledgeable partner (ie. farmers are the experts on the practical use of cover crops in sustainable farming systems).

While scientific research-based knowledge on winter cover crops is available, the best source of information on the practical application and management of winter cover crops is farmer experience. Scientific research suggests that the contribution of nitrogen from a winter cover crop of hairy vetch is not adequate to produce an optimum corn yield. However, farmer experience suggests that this is not true in all cases. Scientific findings demonstrate that rye cover crops deplete the soil of moisture in the spring and can hurt subsequent crop yields. Again, farmer experience says this is not necessarily the case given good management. The difference between scientific research and farmer experience may be in the management of the cover crop within the total farming system.

The reductionist nature of scientific research does not encourage the systems perspective needed to understand the complexities of decision making at the whole-farm level. Both scientific research and practical experience are important for complete understanding, yet scientists often discount the value of experiential knowledge. These workshops will value both scientific and experiential knowledge by attempting to satisfy both scientific validity and the need for local relevancy. The topic of winter cover crops provides an opportunity for exploring and changing the current relationship (unidirectional) between students and teachers. Further, the knowledge gained by all participants on the use of winter cover crops will have an important effect on the sustainability of farming systems in Illinois.

Objectives And Rationale

1. To educate Cooperative Extension agents, Soil Conservation Service staff, Natural Resource personnel, and crop consultants on the practical use of cover crops in farming systems. Many educators currently employed by government agencies and private firms who impact decision making on the farm have little personal experience or knowledge of the use of cover crops in agricultural production systems. If cover crops are to become a useful tool in modern crop productions, better understanding of their practical use is needed. One of the best sources

of current information on the practical-application, advantages and disadvantages of various types of cover crops, is farmer experience. This indigenous knowledge based on personal experience will be shared with agricultural professionals in a workshop format that includes both classroom and hands-on field activities.

2. To identify research needs of farmers and the educational needs of farmers and scientists on the long-term effect of using of cover crops in sustainable farming systems. Both constraints and opportunities exist regarding the use of cover crops in traditional farming systems. These will be explored by workshop participants in order to identify specific research and educational needs of farmers and scientists. The workshops will help agricultural professionals gain a better understanding of the needs of farmers and thus, be better prepared to develop effective research and educational programs to serve those needs. In addition, the working relationship that develops within this farmer/researcher coalition should improve the interaction among these groups in the future.

Project Duration: One Year, ending Aug. 31, 1993
Total funding: $10,000
Matching: $5,000

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Illinois Sustainable Agriculture Society, $9,000, ($2,000);
Illinois Department of Agriculture, $0, ($1,500);
University of Illinois, $0, ($1,500); and
Illinois Sustainable Agriculture Network, $1,000, ($0).

LNC92-43: REGIONAL EXTENSION AND EDUCATION CURRICULAR MATERIALS FOR SUSTAINABLE AGRICULTURE

Major Participants:

University Of Nebraska: James W. King (Project Coordinator), Communications Specialist; Charles Francis, Extension Crops Specialist; Pam Murray, Center for Sustainable Agriculture

Farmers Participants:

Jim Bender, Nebraska; Sara Dean, Kansas; Ron Ellermeier, Nebraska; Fred Kirschenmann, North Dakota; Ron Rossman, Iowa

Other Specialists:

Don Bullock, University of Illinois; Kent Crookston, University of Minnesota; Richard Cruse and Jerry DeWitt, Iowa State University; Jerry Doll, University of Wisconsin; Clive Edwards, Ohio State University; John Gardner, North Dakota State University; John

Ikerd, University of Missouri; Jayne MacLean, National Agriculture Library; Linda Oyer, MRTC/SCS, Lincoln, Nebraska.

Overview

This project is evaluating and developing a broad, interdisciplinary, integrated materials and curricula in sustainable agriculture for use by Extension and SCS in-service training, government agencies, private organizations and high school teachers. Farmers, Extension and SCS specialists, classroom teachers, and researchers will collaborate in writing background materials, developing slides and videos, and identifying key, future curricular needs. A regional conference will bring together innovative farmers and ranchers, Extension specialists, classroom teachers, and researchers to share materials and refine these products, and begin the dissemination process.

Objectives

1. Catalyze the writing of issue-oriented background papers and assemble key teaching and training materials in critical dimensions of sustainable agricultural systems.

2. Organize an interdisciplinary regional conference to present these new materials and assess the broader needs for future materials development.

3. Catalog and make available the conference materials, and other products in the area of sustainable agriculture -- including course syllabi, key papers, and visual materials.

4. Make references, courses and modules, and other materials available at low cost and in a timely manner across the region and the country by using and taking advantage of the latest in communication and information technologies.

Project Duration: One year, ending Aug. 31, 1993
Funding: $34,081
Matching: $17,000

LNC92-44: ON-FARM RESEARCH AND DEMONSTRATION OF RIDGE TILLAGE FOR SUSTAINABLE AGRICULTURE

Major Participants:

Practical Farmers of Iowa: Tom Franzen, Farmer; Richard Thompson, Farmer

Iowa State University: Derrick N. Exner (Project Coordinator), Soil Fertility; Gary H. Huber, Education Coordinator; Tony Harvey, Extension Agriculturalist

Overview

In Iowa about 21 million acres are planted to corn and soybeans annually, which is over 60 percent of the state's farmland (Iowa Agricultural Statistics, 1991). Nearly 70 percent of the corn and over 90 percent of the soybeans are grown in rotation with each other, usually with conventional tillage and multiple herbicide products broadcast over entire fields (Duffy and Thompson, 1991). This predominance of row crops that are farmed conventionally causes problems with soil erosion, ground and surface water contamination, and reliance on off-farm purchased inputs. It also means that if sustainable agriculture is going to make inroads in Iowa and states with similar cropping patterns, efforts are needed to evaluate and promote alternative row crop production systems that will help achieve the goals of sustainable agriculture.

Ridge tillage is an alternative production system that can compete economically with conventional practices while reducing total tillage, soil erosion, runoff, herbicide use, energy consumption, and reliance on off-farm purchased inputs. With ridge tillage the pre-plant tillage operations of conventional agriculture are absent. This is an important benefit of ridge tillage because pre-plant tillage stimulates weed seed germination and leaves soil vulnerable to erosion from spring rains. With ridge tillage, whole-field applications of herbicides are replaced with banded or spot-treatment, and weeds can even be managed solely with mechanical and cultural practices. This lessens the likelihood of ground and surface water contamination and helps decrease reliance on purchased off-farm inputs. Ridge tillage is also economically competitive. The District 7 winner in the conservation tillage division of the 1991 Iowa Master's Corn Growers contest used ridge tillage and only 60 pounds per acre of purchased nitrogen fertilizer for a yield of 204 bushels per acre. As an alternative row crop production system in a state dominated by corn and soybeans, ridge tillage offers much potential to achieve the goals of sustainable agriculture.

Practical Farmers of Iowa (PFI) is a private non-profit membership organization of farmers who share a desire to use resources more efficiently. PFI has had a history of success in evaluating sustainable practices and sharing information on those practices proven to be beneficial, including ridge tillage. PFI's way of evaluating sustainable practices is with replicated on-farm trials that are conducted with the consultation of Iowa State University researchers. Since 1987 PFI farmer-cooperators have planned and conducted 233 replicated on-farm trials using an experimental design that has been determined to have statistical precision approaching the best experiment station trials (Rzewnicki, 1988). These on-farm trials are aimed at gathering information on specific topics of interest to farmer-cooperators, but through farm field days they also serve as focal points for interest in sustainable agriculture practices in Iowa. PFI has been tremendously effective in reaching people through these field days. Total attendance at the 20 to 30 field days carried out annually on farms of PFI cooperators since 1989 exceeds 4,100.

The project will involve 25 PFI farmer-cooperators across the state who will carry out replicated trials on particular aspects of ridge tillage. Concurrently with these trials, cooperators will host farm field days during the summer months to explain the production system and the nature of the research questions being examined. Farmers attending these events will not only see innovative, sustainable uses of ridge tillage, they will view the development process - the replicated trials - by which practices are perfected. They will experience the self-help mode of problem solving that distinguishes sustainable agriculturalists, and they will see university

researchers and Extension and SCS personnel collaborating with farmers to accomplish mutual objectives.

Objectives

Given the need for alternative row crop production systems and the capabilities of PFI, the proposed project will center on replicated on-farm trials to achieve two interrelated objectives.

1. To demonstrate that ridge tillage is economically competitive with other systems while helping achieve the goals of sustainable agriculture.

2. The second objective of the proposed project will be to increase the information base on the management of ridge tillage for sustainable agriculture through replicated research trials conducted on farms by PFI farmer-cooperators with the consultation of university researchers.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $75,867
Matching: $169,396

LNC92-45: MIDWEST ALTERNATIVE AGRICULTURE EDUCATION NETWORK

Major Participants:

Land Stewardship Project: Patrick Moore (Project Coordinator);

Other Organizations: Jerry Jost, Kansas Rural Center, KS; Audrey Arner, Sustainable Farming Association, MN; Charles Cornillie, Sustainable Farming Association, MN; Dave Podoll, Northern Plains Sustainable Agriculture Society, ND; Ed Reznicek, Kansas Organic Producers, KS; Susanne R. Schill, Northern Plains Sustainable Agriculture Society, ND; Jim Tjepkema, Rodale Research Center, MN; Sam Welsch, Nebraska Sustainable Agriculture Society, NE; Gary Young, Nebraska Sustainable Agriculture Society, NE.

Overview

The Midwest Alternative Agriculture Education Network (MAAEN) is a new coalition of six major sustainable agriculture organizations and institutions in the Upper Midwest. The charter members of MAAEN are: The Kansas Rural Center, the Land Stewardship Project, the Midwest Rodale Research/Extension Network, the Nebraska Sustainable Agriculture Society, the Northern Plains Sustainable Agriculture Society and the Sustainable Farming Association of Minnesota. The overall goal of MAAEN is to develop and provide midwestern farmers with information and educational programs on alternative agriculture systems. This will be achieved through meetings, a newsletter, a speaker's bureau, teleconferences, and publications developed jointly.

Objectives

1. To increase communication about sustainable agriculture education efforts being carried out within the non-profit sustainable agriculture community in the Upper Midwest.

2. To increase communication and cooperation between the non-profit sector, land grant universities and government agencies in developing educational programs and materials relating to sustainable agriculture.

3. To collaborate in the development and delivery of innovative educational programs and materials relating to sustainable agriculture.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $120,000
Matching: $121,500

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Sustainable Farming Association of Minnesota, $21,600, ($30,000)
Kansas Rural Center, $23,600 ($31,600)
Nebraska Sustainable Agriculture Society, $21,600, ($7,500)
Rodale Institute, $21,600, ($22,000)
Northern Plains Sustainable Agriculture Society, $20,100, ($20,400)
Land Stewardship Project, $11,500, ($1,000)

LNC92-46: CONTOUR STRIP INTERCROPPING AND ROTATIONS TO REDUCE SOIL EROSION AND ENERGY COSTS IN PRODUCTION SYSTEMS

Major Participants:

University of Nebraska: Charles Francis (Project Coordinator), Cropping Systems and Extension Specialist; Glenn Helmers, Agricultural Economics; Alice Jones, Agronomist and Tillage Specialist; Terry Klopfenstein, Animal Science

Soil Conservation Service, Midwest National Technical Center: Linda Oyer, Soils and Tillage Specialist; Robin Riley, Agricultural Economist; Roger Kanable, Conservation Agronomist.

Overview

Approved farm plans to meet the federal requirements on minimizing soil erosion on sloping lands often involve leaving residue on the soil surface or constructing terraces. Although the use of contour strip intercropping is an acceptable method of meeting these requirements, few farmers have instituted it. This may be due to minimal research and precise data on these soil conserving practices, as well as few demonstrations or practical examples that are available for farmers to evaluate for themselves how effective this approach can be. Compared to terraces,

the implementation of contour strip intercropping is much more rapid, less costly, and less disruptive of the topsoil on which crops depend.

Crop rotations of unlike species are well established methods of increasing crop yields and improving the biological structuring of a whole-farm system. It is generally accepted that rotations increase yields of most crops, on the average, by ten percent compared to continuous cropping. Although many farmers rotate entire fields on an annual basis, eg. corn with soybeans, few have envisioned or put in practice the alternative of crops in contour strips and rotation of the strips each year. This can provide rotation effects on crop yields, enterprise diversity on the whole farm, and biological diversity in the field to reduce soil erosion and promote some level of pest management compared to monoculture cropping. Grazing crop residues provides another integration with livestock production. Coupled with ridge tillage or minimum till planting and all residues left on the surface, this practice could help a farmer meet minimum erosion standards while creating a more diverse and sustainable system in each field.

Objectives

The objective of this project is to quantify the effects of contour strip intercropping and rotations in reducing soil erosion, input and energy costs, and off-farm effects of crop production. To meet this general objective, the project will use historical data and new field plantings to:

- compare diversified strip intercropped and crop rotation landscapes with monoculture (continuous) corn and corn-soybean rotations on highly erodible lands in eastern Nebraska.

- calculate biological, ecological, economic, and water quality impacts of these systems on single fields, whole farms, and watersheds in terms of yields, net returns, energy use and savings, soil erosion control, and water quality.

- simulate new combinations of component technologies and other rotations from these trials to provide a data base to develop innovative systems for future field testing.

- conduct demonstrations and field days at the experiment station and on fields of collaborating farmers, using SCS, ASCS, Cooperative Extension, Nebraska Sustainable Agriculture Society, and industry meetings and other channels where this information is needed.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $45,000 per year for a total of $90,000
Matching: $107,620

LNC92-47: INNOVATIVE APPROACHES TO PRACTICAL EDUCATION IN SUSTAINABLE AGRICULTURE

Major Participants:

The Ohio State University: Clive Edwards (Project Coordinator), Entomology; Bill Shuster, Assistant Farm Manager; Don Pritchard, Extension

Stratford Ecological Center: Jeff Dickinson, Project Manager; Kamyar Enshayan, Education Coordinator; Jack Warner and Louise Warner

Ohio Ecological Food and Farm Association: Phillip Hale, On-Farm Tour Coordinator; Mike Laughlin, Certification Manager

Ohio Department of Agriculture: Don Noah, Deputy Director; John Davis, Agricultural Education Service; Jon Cherniss, Farm Manager

Oberlin College: David Orr, Environmental Studies

Farmers: Ted and Molly Bartlett, Silver Creek Farm; Ken and Lyn Chapis, Beam Road Berry Farm.

Overview

This project seeks to provide an interdisciplinary education of carefully selected, leadership-oriented students in the principles and practices of a more sustainable agriculture, through a hands-on, farm-based experience. Through this project, interns will be educated in the principles and practices of sustainable agriculture. We shall further develop two model demonstration farms to further the goals of sustainable agriculture through on-farm education and research opportunities to a regional Demonstration Farm Network which will include at least 30 different commercial farms. Also, the Association of Innovative Farmers will be formed and include at least 40 practicing innovative farmers and at least 60 additional members represented by students and agricultural practitioners.

Objectives

1. To provide practical on-farm educational training in Sustainable Agriculture, for career and leadership-oriented students and young farmers, through a Sustainable Agriculture Internship Program. The program will offer 10 competitive scholarships annually to outstanding students, to allow them to attend an intensive 12-week Sustainable Agriculture Internship Program co-sponsored by Ohio State University, the Stratford Ecological Center, and the Ohio Ecological Food and Farm Association (OEFFA).

2. To provide opportunities for practical on-farm educational experiences on a network of demonstration farms in Ohio.

3. To develop an "Association of Innovative Farmers" as a resource for practical education in sustainable agriculture.

Project Duration: Two years, ending Aug. 31, 1994.
Funding: $112,390
Matching: $148,579

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

The Ohio State University Research Foundation, $68,180, ($107,899);
Stratford Ecological Center, $38,165, ($37,835); and
Ohio Ecological Food and Farm Association, $6,045, ($2,845).

LNC92-48: EVALUATING RELATIVE IMPACTS OF CONVENTIONAL AND SUSTAINABLE FARMING SYSTEMS ON RURAL COMMUNITIES

Major Participants:

University of Missouri-Columbia: John Ikerd (Project Coordinator), Agricultural Economist; Gary Devino, Agricultural Economics

University of Minnesota: Richard Levins, Agriculture Economist

Center for Rural Affairs: Nancy Thompson, Attorney, Program Leader for the Center for Rural Affairs Rural Economic Opportunity Program

Overview

This project will develop a conceptual framework and computational tool kit appropriate for estimating the potential impacts of rural communities as farmers move toward more sustainable systems of farming. There will be two important target audiences. The primary audience will be farmers and rural community leaders who are interested in working together to develop effective strategies for sustainable development of the natural and human resources of their communities. An intermediate audience will consist of professionals in cooperative extension, state governments, and private non-profit organizations who work with communities on rural development issues.

The models developed in this project will emphasize important differences between conventional agriculture and the alternative or sustainable agriculture models in the assessment of impacts on rural communities. This project will result in the redirection of professional rural development programs, giving greater attention to the potential contribution of a sustainable agriculture to sustainable development of rural communities.

Objectives

1. To facilitate community self-appraisal of the potential to increase local employment and income by supporting transitions of local farmers from conventional to more sustainable systems of farming.

2. To facilitate practical community-specific evaluation of potential impacts of more sustainable local agricultural sectors on the overall long run sustainability of rural communities.

3. To promote an understanding and realization of potential positive linkages between sustainable systems of farming and sustainable rural communities; considering the economic, environmental, and social dimensions of sustainability.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $99,244
Matching: $88,426

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Missouri, $54,244, ($55,426);
University of Minnesota, $30,000, ($28,000); and
Center for Rural Affairs, $15,000, ($5,000).

LNC92-49: ON-FARM DEMONSTRATION AND EVALUATION OF SUSTAINABLE FARMING SYSTEMS

(Revised May 31, 1993)

Major participants:

Missouri Sustainable Agriculture Society: William Dellinger (Project Coordinator), Executive Director

University of Missouri: John Ikerd, Extension

Farmers: Ron Harmon, Chariton County, MO; Lynn Fahrmeier, Lafayette County, MO; Don and Deloris Easdale, Knox County, MO; Larry Brotherton, Livingston County, MO.

Overview

Component technologies have helped and can continue to help improve agricultural sustainability. But, added emphasis must be placed on how the components fit together to form farming systems. Effective interdisciplinary research is not merely a lumping together of individuals from various disciplines but, instead, must represent a synthesis of ideas and view-points coming together in a synergistic fashion. Components, likewise, must be synthesized into synergistic systems.

The integration of research and extension programs in conducting farming systems research is critically important. However, farmers are perhaps the ultimate systems integrators and, thus, can serve as important members of systems research teams. They have the advantage of not viewing the problems from a disciplinary orientation and, thus, may identify components of a problem that would be missed by a group of disciplinary scientists.

Farmers will be recruited to participate in on-farm research projects through contacts with area Extension specialists, Soil Conservation agents, and the Missouri Sustainable Agriculture Society. Each farmer will be asked to document his or her current whole-farm plan and alternative farm plan which would integrate the alternative farming methods to be tested. The microcomputer based SMART Farm Resource Management System will be used to assess potential soil loss, water quality risks, production levels, and profitability of the alternative systems. This approach will help document the logical linkages between the specific farming methods that are the focus of research and other components of the whole-farm system.

The demonstration program will be coordinated by the Missouri Sustainable Agriculture Society. However, farmer participation will not be limited to its members. Farmers will be reimbursed for their participation in a manner consistent with MO-SAS and other on-farm research and demonstration networks operating in Missouri and surrounding states. University of Missouri Extension will support farm tour publicity and will provide documentation, printing, and distribution of demonstration results. A field-person employed by MO-SAS will coordinate the on-farm demonstration program as well as assist with the on-farm research program.

Objectives

The overall objective of this project is to evaluate and demonstrate the relative sustainability of conventional and alternative farming systems being considered for adoption by Missouri farmers. Specific objectives are:

1. To assess the economic and ecologic sustainability of the farming methods below as alternative or supplements to conventional methods of pest management and soil conservation within the context of whole-farm systems.

2. To demonstrate the economic and ecologic sustainability of the following farming methods as alternatives or supplements to conventional methods of pest management and soil conservation within the context of whole-farm systems.

    A. Ridge tillage
    B. Cover crops
    C. Agroforestry
    D. Intensively managed grazing and
    E. Others, as suggested by farmers.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $65,250
Matching: $62,585

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Missouri-Columbia, $30,000, ($32,585) and
Farm Alliance for Rural Missouri, $35,250, ($30,000).

LNC92-50: SOCIAL AND CULTURAL FACTORS AFFECTING SUSTAINABLE FARMING SYSTEMS AND THE BARRIERS TO ADOPTION

Major Participants:

University of Illinois at Urbana-Champaign: Sonya Salamon (Project Coordinator), Family Studies; Richard Farnsworth, Resource Economics; Donald G. Bullock, Crop Production

Farm Families: Thirty families will be involved

Overview

Current research in sustainable farming systems tends to focus on agronomic and profitability issues, neglecting social and cultural factors. Scanty information is available about the social, cultural, economic and environmental consequences to farm families and rural communities of adopting more sustainable systems. Furthermore, we know little about the fundamentally social problems that inhibit switching to sustainable agriculture apparent in the limited adoption of such systems. The proposed project is uniquely designed around the collaboration of a multidisciplinary research team, able to simultaneously examine the social and cultural, environmental, and production factors of a farming system. Approaches used by an anthropologist, natural resources extension economist and an agronomist complement each other and will result in generation of the first interdisciplinary data base incorporating a true whole-farm perspective.

Objectives

1. To determine the family and enterprise preconditions or barriers to adopting sustainable farming systems.

2. To identify and assess the environmental and economic consequences for the rural community of families farming with sustainable versus conventional systems.

3. To develop an innovative educational program that identifies the real-life costs and benefits to families using sustainable versus conventional farming methods.

The project pivots on data collection entailing in-depth questionnaires and a semi-structured interview with a total sample of 60 families, chosen according to a controlled comparison design. A set of 10 Illinois farm families using sustainable farming systems are to be paired with a set using conventional farming systems from three blocks each characterized by operations representative of the wider North Central Region: northern Illinois/mixed livestock and grain; central Illinois/grain; and southern Illinois/mixed fruit and grain. Community, climatic and environmental contexts are to be controlled for by selecting the family pairs from a representative county in each block and sharing ethnicity, lifecourse phase, and common farm size, proportion of land owned, soil productivity, and geographical conditions. By holding these factors constant the controlled comparison design concentrates on the farming system contrasts between the family pairs and casts into sharp relief possible references in cultural and social factors associated with the adoption of sustainable farming systems.

Each pair set will be studied during one week on the farm, and the family rather than a single male farmer will be the focus. Questionnaires, interviews, and observation of families in everyday activities will be combined to generate a data base composed of three parts: the physical aspects of the farm; production practices; and the social and cultural characteristics of the farm family. Family and land histories, division of labor, goals, ecological beliefs and succession plans among other information, and data from participant observation of the family in the midst of everyday activities are to be obtained using anthropological methods. Patterns in these data can be used to determine the social/cultural barriers to, and those traits associated with, adopting a particular farming system.

The physical description of the farm and surrounding area, detailed production and economic information that includes production costs, assets and debts for the present and a representative previous year (before the switch for those farming with sustainable systems) will be obtained with a structured questionnaire. From these data each farm's ecological and economic viability will be determined and used to compare the matched farms at the time when both used conventional methods with the period after the subsequent shift by one to a more sustainable system. Statistical analysis will be used to indicate the physical, production, and economic factors versus the social and cultural factors for each farming system. Furthermore, these data will enable us to identify whether it is the family or other properties of the farm that account for different production and environmental outcomes.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $72,018
Matching: $58,037

LNC92-51: DEMONSTRATION OF LIVESTOCK GRAZING AS AN ALTERNATIVE TO ROW CROPS ON HIGHLY ERODIBLE LAND FOLLOWING CRP CONTRACTS

(May 31, 1993)

(This is a continuation of LNC91-36. This project focuses on disseminating the results of the research and demonstration project and educating the educators with information learned from the first three years.)

Overview

The primary goal of this project is to use the previously established team concept to "educate the educators" about economically sound and environmentally safe alternatives to row crop production on highly erodible, marginal soils in the area. The first three years of this project were partially funded by the Sustainable Agriculture Research and Education Program.

Objectives

1. To facilitate and increase farmer understanding of sustainable agriculture, particularly the use of alternatives to row crop production on highly erodible acres;

2. To conserve, maintain and enhance the quality and production of the soil;

3. To transfer practical information (technology learned from this project) to operators of various sizes of farms; and

4. To enhance the quality of life for southwest Iowa farmers by increasing income and employment opportunities on highly erodible or CRP acres no longer under contract.

After three years of researching alternative forage and grazing systems on this demonstration farm in cooperation with Iowa State University, SIFLC members now intend to transfer this information to the farm community and operators by "educating the educators." It is their intent to achieve this objective through a comprehensive communication/education effort, which will include:

- developing a brochure to explain the purpose, need and activities of the research and demonstration project, as well as its location and tour hours.

- conducting a highly promoted annual field day and on-going tours at the CRP Research and Demonstration Farm.

- providing informational meetings for area groups, such as Vocational Agriculture Adult Farmers, Greenhills Hay Association, Cattlemen's Association and others.

- sharing information at area meetings and trade shows already scheduled through the creation of a demonstration model and presentation by researchers.

- hosting a two-day seminar at the CRP Research Farm in Corning, Iowa in 1993 and 1994 for key agricultural producers, agency personnel and farm leaders/educators in southern Iowa.

- developing an annual report to review the accomplishments and findings of the research and demonstration project.

Researchers have three years of data to share with educators. This data from the 480-acre demonstration farm includes research findings from the following research:

- intensive grazing systems on 12-14% slopes using a contour lane system;

- the use of a variety of cool-season grasses, legumes, native grasses and establishment methods in existing CRP forage;

- control of musk thistle while maintaining legumes in the forage stand; and

- information from the surveying and evaluation of existing CRP contracts in Adams County for type and quality of forage, fence quality, water supply and land ownership characteristics.

This information will be offered in a variety of formats, including on-farm demonstrations. These demonstrations will include the presentation of information on yields,

costs, pesticide use, net returns and financial risks due to the adoption of sustainable agriculture alternatives, as presented by ISU researchers/agronomists, SCS researchers and agency personnel currently assisting in project demonstrations.

Educational materials will highlight the differences of adopting these practices on various farms in southwest Iowa, noting the differences in effectiveness based on soil characteristics, cropping history, climate and agricultural prices. Since no research involving alternative uses of CRP land is currently available to agricultural producers, this information will prove instrumental in establishing hayland, pasture and other alternative farming systems on highly erodible land that was previously row cropped.

And, lastly, while this project is not directly related to pollution prevention, its overall effect and/or result may lead to pollution prevention practices through the use of soil-conserving measures on highly erodible acres at the completion of CRP contracts. By converting highly erodible acres previously used for row crop production to pasture, hayland or other uses, the environment -- streams, soil conditions, etc. -- will be beneficially affected.

Project duration: Two years, until Aug. 31, 1994
Funding: $12,445
Matching: $14,200

LNC92-52: THE ADOPTION OF LISA TECHNIQUES OF PEST MANAGEMENT BY NORTH CENTRAL FRUIT GROWERS

(Revised May 31, 1993)

Major Participants:

Michigan State University: Craig K. Harris (Project Coordinator), Sociology; Tom Edens, Resource Development and Entomology; Mark Whalon, Entomology; Jim Nugent, Cooperative Extension Service.

Overview

One of the main barriers to the widespread utilization of LISA techniques for pest control in fruit production is the necessity of passing through a period of transition. Growers expect that during this period they will experience a decrease in production, a rise in pest problems, and a reduction in income. These problems arise in part because, relative to other farming practices, LISA techniques appear "lumpy"; they are perceived by some growers as requiring simultaneous implementation as a total package rather than gradual and piecemeal adoption. Given this "all-or-none" perception, farmers are reluctant to move toward LISA methods. The proposed research will determine whether multiple trajectories of transition are in fact feasible and potentially successful.

Those growers who do attempt to implement LISA techniques face another problem. Often it is difficult to obtain accurate information about specific aspects of LISA methods, or the information which is available is not specific to their area or crop. In this situation, farmers

seek to adapt the general outlines of certain methods to the specific conditions of their operations. But in doing so, they sometimes alter the practice of the technique to such an extent that either it will no longer be effective or it would not be classified as a LISA technique. A recent survey of fruit growers found that many described themselves as using integrated pest management (IPM) techniques, but from descriptions of their specific practices it was clear that their practices were not significantly different from conventional methods.

Both of these problems occur, at least in part, because models of successful transitions are not available to farmers. Growers who would like to move toward more sustainable techniques are not aware that others have successfully done so, and lack specific information about how their own operations might do so. The proposed project will identify models of successful transitions in fruit production in the North Central region. These models will be publicized to growers and to extension agents who specialize in fruit in the form of transitional guidelines which are incorporated into Cooperative Extension activities through IPM Schools, agent training and a "Fruit Transition" bulletin.

Objectives

One of the most significant challenges to our society today is the facilitation of the transition from conventional to more sustainable agricultural production practices. To meet this challenge, we need to know the key socioeconomic and production elements that will facilitate this transition. This proposed project is designed to provide that knowledge. Its objectives are:

1. To describe the actual transitions of fruit growers from conventional pest control methods to LISA methods by identifying:

   (a) the socioeconomic and production factors which caused growers to shift methods;
   (b) the process whereby growers shifted from conventional to LISA methods of pest control; and
   (c) the factors which facilitated or impeded that shift.

2. To describe the current state of LISA methods of pest control by identifying the actual practices which growers are using for pest management under the rubrics of IPM, PPM and organic techniques.

3. To forecast the future state of LISA methods of pest control by assessing the economic, social and physical sustainability of growers' current methods of pest control.

Methodology

In order to represent the variety of problems in making the transition to LISA methods of pest control for fruit production, three types of fruit will be selected. Apples are the largest crop in the region; tart cherries are representative of the stone fruits; and blueberries are a high value crop with large direct marketing.

The North Central region can be divided into three agroecological zones -- southern coastal, inland, and northern coastal. In each zone, four types of growers will be identified. The first group will be growers who are making a transition from conventional methods of pest control to IPM. The second group will be growers who have fully implemented IPM

techniques. The third group will be growers who are making a transition to organic techniques or a similar regime of pest control, while the fourth group will be growers who have fully implemented such techniques. Analysis of the 1990 Michigan fruit survey showed that it was possible to distinguish these four groups. Since a large amount of information is available about growers using conventional techniques of pest control, a conventional group is not needed.

Personal interviews will be conducted with 72 grower cooperators to identify what pest control techniques are currently being used. Growers in the second and fourth groups will be asked to describe the process they went through to make the transition from conventional methods of pest control. Growers in the first and third groups will be asked what approach they are using in making their transitions. All of the groups will be asked what socioeconomic and production factors led to their decision to make a transition.

Sustainability has three dimensions: economic, social and biological. To assess the economic sustainability of the 72 operations, farm budgets will be calculated for each year of the study. To assess sustainability on the social dimension, attitudes toward resource conservation and levels of satisfaction will be measured both for the principal operators and for members of their families. Resiliency, diversity and energy subsidy will be assessed as the key parameters of biological sustainability.

These three dimensions (economic, social and biological) will then be integrated into transitional profiles across time. In conjunction with the other data from the interviews, these profiles will be used to develop different models of the transition trajectory. These models will then be simplified into operational models suitable for implementation. It is these operational models which will be incorporated into printed materials and disseminated through educational sessions by various organic, sustainable farming, and Cooperative Extension organizations.

During the final phase of the project, the results of the analysis will be presented to the cooperators for evaluation. Meetings and electronic and print media will be used to communicate the transition guidelines to other fruit growers in the North Central Region. The dissemination of the results of the research will be facilitated by the dense communication patterns which characterize fruit growers. The results will be presented at a session of the 1994 Michigan State University Agriculture and Natural Resources Week.

Project Duration: Two years, ending Aug. 31, 1994
Funding: $42,410
Matching: $48,370

LNC92-53: ROTATIONAL GRAZING SYSTEMS FOR WISCONSIN AND MINNESOTA DAIRY FARMERS: AN EVALUATION OF ANIMAL AND FORAGE PERFORMANCE AND WHOLE-FARM SOCIO-ECONOMIC ANALYSIS

Major Participants:

Wisconsin Rural Development Center: Denny Caneff (Project Coordinator), Executive Director; Joe Meudt

University of Wisconsin-Madison: Ken Albrecht, Agronomist; Mike Casler, Agronomist; David Combs, Dairy Scientist; Craig Sheaffer, Agronomist; Joe Rust, Animal Scientist; Steve Stevenson, Sociologist; Rick Klemme, Agricultural Economist

Northeast Wisconsin Sustainable Ag Network: John Bobbe

Wisconsin Farmers: Don and Kathy Austin, Platteville; Harley and Nancy Troester, Potosi; Vince and Barb Garvoille, Spring Green; Mike and Charlotte Cannell, Cazenovia; Dan Patenaude, Highland; Jim and Jane Heisner, Mineral Point; Mark and Sheri Levandoski, Genoa; Patrick Olson, Sturgeon Bay; Scott and Lori Delcorps, Sturgeon Bay; Kevin Kiehnau, Egg Harbor; Lyle Nelson, Sturgeon Bay; Rick Adamski and Valerie Dantoin, Seymour

Minnesota Farmers: Dan and Muriel French, Dodge Center

Overview

Both on-farm and experiment station research will be conducted in Minnesota and Wisconsin to measure, analyze and communicate the technical, production and socioeconomic implications of intensive rotational grazing (IRG) systems. A team of researchers, farmers and a nonprofit organization seek $189,210 over two years for research and outreach on IRG systems for dairy farms in the two states.

This is a continuation of two years of research and outreach already funded by the LISA program. Experiment station research will examine both the effects of grazing on pasture performance, and how grazing impacts animal weight gain and milk production. Experiment station research will evolve to a study of ration balancing on pastures, and determining the best performing pasture mixes. On-farm research and demonstration will look at how IRG systems are adopted and utilized by farmers; how certain grass varieties perform under grazing conditions; how much more (or less) grain is needed in the ratio to minimize feeding costs and optimize production; how IRG systems compare economically to conventional, stored-feed dairy systems; and how seasonal milking conforms to IRG systems.

An additional, unique and important component of this project looks at the problems and advantages of scientists and farmers sharing their particular perspectives and experiences on a farming problem and working together to solve it.

Objectives

1. Experiment Station Component

   a. Compare productivity of two IRG systems with a conventional stored forage confinement systems (1991-93 only).
   b. Monitor grazing patterns of cows and identify relationships between forage selection by animal and ruminant environment (1991-93 only).
   c. Measure production response to supplemental grain in dairy cattle that are grazing grass-legume pastures in an IRG system (begin in 1994).

Site: Arlington Experiment Station, University of Wisconsin.
Investigators: David Combs, UW-Madison dairy scientist; Ken Albrecht, UW-Madison.

   d. Compare the effects of continuous (conventional) grazing and IRG systems using three stocking rates on animal weight gain per day and per acre.
   e. Compare the effects of these grazing systems on pasture forage production, forage quality and stand characteristics.

Site: Grand Rapids Experiment Station, University of Minnesota.
Investigators: Joseph Rust, University of Minnesota animal scientist (emeritus); Craig Sheaffer, University of Minnesota agronomist.

2. On-Farm Component

   f. Evaluate 240 meadow fescue accessions and varieties and 250 quackgrass populations and collections for persistence, productivity and palatability in IRG systems.

Site: Three Wisconsin dairy farms practicing rotational grazing.
Investigator: Michael Casler, UW-Madison agronomist.

   g. Conduct a comparative economic analysis of costs and returns for IRG and conventional systems on six of the 12 cooperating farms.
   h. Observe and record animal breeding data; and whole-farm labor, cash flow, lifestyle and other implications of combining seasonal milking (approx. 10 months) with IRG on 3 of the 12 farms.
   i. Examine how changes of grain feeding affect milk yield and composition throughout the grazing season on 2-3 of the 12 farms (starting 1992).
   j. Observe and record pasture management techniques (including establishment strategies, fertilization, seeding rates, plant species, animal movement strategies) on all 12 cooperating farms.

Sites: Working dairy farms in southwestern and northeastern Wisconsin; and one in south central Minnesota.

3. Farmer-Researcher Relationships Component

k. Practice and evaluate "balanced role reversal" model.

This objective goes to the heart of the LISA concept itself: Can researchers and farmers find common ground on which to test, measure and communicate about a farming system? Can they transcend each other's perceived limitations and take advantage of each other's skills and perspectives to advance knowledge about that system: Can they learn from each other? First phase interviews of selected university and farmer participants have already been conducted, and will be followed up at the midpoint and the termination of the project.

Project Duration: Two years, ending Sept. 1, 1992.
Funding: $108,000
Matching: $79,480

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Wisconsin Arlington Experiment Station, $21,540, ($67,430)
Wisconsin Rural Development Center, $86,460, ($12,050)

LNC93-54: LOW-INPUT BEEF CATTLE SYSTEMS OF PRODUCTION

Major Participants:

University of Nebraska-Lincoln: Terry Klopfenstein (Project Coordinator), Professor, Ruminant Nutrition, Animal Science Department, University of Nebraska, Lincoln, NE 68503-0908; Stephen C. Mason, Crop Production and Management; Alice Jones, Soil Sciences: Jim Gosey, Beef Extension; Rick Rasby, Beef Extension; Bruce Anderson, Forage Extension and Research; Rick Stock, Beef Research and Extension.

Overview

Forages and manure can reduce input costs and reduce soil erosion in cropping systems. Because of their unique ability to utilize forages, beef cattle fit into such a farming system. In most cases where costs of beef production are high, input costs are also high and maximum gains, milk production and cow size have been over emphasized. Researchers for this project propose that input costs can be dramatically reduced without greatly reducing output by 1) maximizing use of forage 2) minimizing use of grains 3) maximizing grazing 4) minimizing harvesting of forages and 5) minimizing purchased supplemental feed. Much land in the western Cornbelt is subject to erosion but a large percentage of it can be used for crop production with appropriate tillage and management practices. Resulting crop residues offer an excellent feed resource if they are grazed and not totally removed from the soil. Enough residue must remain on the field to meet requirements of the conservation plan. In addition, many farms have some land that should not be tilled (pasture). The challenge is to integrate economical beef production systems with the forage resources available. Greater use of forages enhances the environment by reducing erosion and chemical use if highly erodible tilled acres are converted to forage crops. This provides an alternative to building structures such as terraces to control erosion.

Cornstalk grazing is a critically important component of a low input sustainable beef production system in the western Cornbelt. However, the impact of stalk grazing on corn production systems has not been investigated. More importantly, the tillage method is critically important to soil quality, tilth, and productivity. How grazing interacts with tillage methods is unknown. Do ridges reduce availability of residues due to trampling in the furrows? Do cattle affect the ridge integrity? Do they affect the benefits of tillage? Do they affect soil compaction and organic matter equilibrium? These are critically important questions for whole-farm systems.

Year-round beef production systems will be compared using cattle from weaning to market via fall stalk grazing, winter feeding, summer grazing, and feedlot finishing. Biological and economic analyses will be completed. Our past research suggests that economics and sustainability favor maximum gains on forage in the summer. Utilizing forages that are complementary to brome or extended grazing into the fall are necessary to accomplish this goal. Red clover will be interseeded into oats and brome, warm-season grass in rotation systems and turnips for fall grazing.

The effects of cattle grazing corn stalks on a ridge tillage system and conservation requirements, and ridge tillage system on cattle grazing stalks will be studied in a 100 acre corn field. The field will be divided into three conventional and three ridge till areas. Each area will be grazed with calves being used in the systems research. There will be control areas left ungrazed as well. The same areas will be maintained for two years or more. Calves will graze during November, December, and January of each of the two years. The following measurements will be taken: corn yields, residue yields, residue quality (digestibility), calf gains, residue utilization, residue remaining after grazing and residue cover with and without grazing. Corn will be evaluated for rate and evenness of plant emergence and population, phenological development, N, P, and K levels of ear leaf and maturity, yield, ears per plant, and seed weight to determine if soil compaction influences nutrient uptake and crop productivity. Soil bulk density, surface residue cover, buried residue, soil strength, water content, available water holding capacity, and aggregate size distribution will be evaluated.

Objectives

1. Develop economical, forage based, low-input-cost beef growing finishing systems to enhance the environment.

2. Determine the effects of cattle grazing corn stalks on ridge tillage system and ridge tillage system on cattle grazing stalks.

3. Trasmit information on low input, economical beef systems to cattle producers through field days, reports and a multi-state symposium.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $70,686
Matching: $81,750

LNC93-55: ECONOMIC AND ENVIRONMENTAL IMPLICATIONS OF 1990 FARM BILL SUSTAINABILITY PROVISIONS IN WATER QUALITY SENSITIVE AREAS

Major Participants:

South Dakota State University: Thomas Dobbs (Project Coordinator), Professor, Agricultural Economics, SDSU; Burton W. Pflueger, Associate Professor, Agriculture Economics and Extension Farm Financial Management Specialist; John H. Bischoff, Assistant Professor, Agricultural Engineering/Water Resources Institute; Charles H. Ullery, Associate Professor, Agricultural Engineering and Extension Water Resources Specialist;

Soil Conservation Service: David Buland, State Economist (South Dakota;

Farmer: Charles Johnson, Sustainable farmer in east-central South Dakota.

Overview

The overall goal of the research covered by this proposal is to determine whether the economic incentives offered by three environmental provisions which were new in the 1990 Farm Bill are sufficient to induce Western Corn Belt/Northern Great Plains farmers in environmentally sensitive ground water areas to adopt sustainable farming practices and systems. The three provisions to be studied are: the Integrated Farm Management (IFM) program option; the Integrated Crop Management (ICM) cost-share program; and the Water Quality Incentive Program (WQIP). All three programs are limited and pilot in nature. National policy makers need to know whether any (or all) of these programs are viable policy options to expand upon and/or substantially modify in the 1995 Farm Bill. The proposed research is intended to provide such policy insights for grain farming areas in which ground water quality is a critical concern.

Specific objectives involve: development of whole-farm models with which to estimate the effects of different farming practices and systems on the employment, output, profits, and ground water quality impacts (primarily nitrate levels) for representative farms; determination of the extent to which farmer participation in the IFM, ICM, and/or WQIP Farm Bill provisions would enhance the profitability--and, hence, adoption-prospects of those practices and systems which are most benign with respect to groundwater quality; and determination of what further changes may be needed in the Federal farm program in order to induce adoption of sustainable farming practices and systems with potential to satisfy ground water quality objectives. The study will be conducted in a 3-county area of eastern South Dakota which is a USDA-designated "Water Quality Demonstration Project Area". Whole-farm analyses will be carried out for three to four case study, representative farms in this study area; at least one irrigated farm and at least two "dryland" farm operations will be included.

Objectives

1. Identify and describe the nature of initial Integrated Farm Management, Integrated Crop Management, and Water Quality Incentive Program participation by farmers in a critical ground water area of eastern South Dakota.

2. Develop whole-farm economic models for three to four typical farms in that area, and

develop enterprise and whole-farm budgets for alternative farm plans that might be used on those farms to comply with the IFM, ICM, and WQIP provisions.

3. Develop estimates of the effects on ground water quality of shifting to the alternative farm plans in Objective 2, giving special emphasis to reducing the likelihood of nitrate contamination.

4. Determine the economic and environmental effects for typical farms of participating in the IFM, ICM, and WQIP provisions of the 1990 Farm Bill, using the whole-farm models and estimates developed for Objective 2 and 3.

5. Determine what further changes may be needed in the Federal farm program in order to induce adoption of sustainable farming practices and systems with potential to satisfy ground water quality objectives.

6. Extend research results to farmers and policy makers.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $82,650
Matching: $97,640

LNC93-56: ON-FARM ADAPTATION OF INTEGRATED CROP AND LIVESTOCK SYSTEMS IN ILLINOIS

Major Participants:

University of Illinois: Robert Hornbaker (Project Coordinator), Associate Professor, Agricultural Economics; Donald G. Bullock, Assistant Professor, Crop Production; C. J. Kaiser, Extension Forage Specialist; Dennis W. Gehrt, Trust Farm Manager; David C. White, Farm and Resource Management Laboratory Coordinator;

Farmers: Jack Erisman, Pana, IL; Gary Ewing, Pana, IL.

Overview

The project is a response by the University of Illinois to the growing interest within the farming community of Illinois in production alternatives to increase flexibility, self-sufficiency, and stewardship of the environment. This project will examine the advantages obtainable from more diverse farming systems and address questions of economic viability of the systems. In addition to the growing general interest, a landowner has provided a significant catalyst by making a commitment of capital (land and money) dedicated to long-term research and education addressing sustainable agriculture. The proposed project is designed to be fully contained in two years. At the same time, the project will serve as further catalyst for a longer-term study, as intended by the landowner providing the research site.

This two-year project will establish both replicated experiments and full-scale

implementation studies on 225 acres being provided for the express purpose of this kind of research. The small-scale, replicated experiment component will be supervised directly by the researcher scientists involved. Two production systems typical of cornbelt farming will be established for comparison; continuous corn and a corn/soybean rotation. Two other systems will introduce forage crops; corn/annual alfalfa (hay) and a rotational grazing system on perennial alfalfa/smooth bromegrass pasture. The full-scale implementation studies (of the systems without livestock) will be controlled through a more typical farm management administrative structure. In both cases, the monitoring and assessments will be guided by the interdisciplinary oversight team including farmers and farm managers.

Field days will be sponsored, in cooperation with the Cooperative Extension Service and other agencies. The education component will emphasize the complexity of the production systems and their underlying natural resources. In addition to the on-site educational efforts, the research will also provide valuable information for more widely delivered cooperative extension programs. And, the attention given to the replicated design of the small-scale study will enable findings to be rigorously interpreted and published for the academic community. What may prove of most value are the lessons we may learn comparing results from replicated small-scale trials, with full-scale operations of the same systems right along side.

Objectives

1. To conduct replicated small-scale experiments examining four alternative agricultural production systems involving various combinations of grains, hay, and grazed forages;

2. At the same time, adapt three of these production systems on an essentially full-scale basis, with 40-60 acres dedicated to each system;

3. Monitor, analyze and document environmental and economic consequences of all the production systems under study; and

4. Sponsor annual on-farm demonstrations and exhibits, install signage for the benefit of farmers in the county and region, and interpret results in published research and cooperative extension education programs.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $92,994
Matching: $239,520

LNC93-57: IMPROVING NITROGEN UTILIZATION WITH ROTATION AND COVER CROPS

Major Participants:

Michigan State University: Richard R. Harwood (Project Coordinator), Integrated Cropping Systems; Ernesto France-Vizcaino, Visiting Professor, Crop and Soil Sciences; John Paul "Jack" Knorek, Extension Agricultural Agent; Gerald D. Schwab, Agricultural Economics; Scott M. Swinton, Agricultural Economics

Farmers: Tom Guthrie, Roger French, Robert Fogg

Objectives

1. To demonstrate that crop diversity of up to six selected species in rotation in four years will significantly enhance soil microbial biomass and activity.

2. To demonstrate that this diversity, when carefully arranged in rotation may result in greatly enhanced soil nitrogen mineralization and availability early in the season and decrease soluble soil nitrogen by early winter. Leaching is expected to be dramatically reduced.

3. To demonstrate the degree to which these processes may be enhanced or disrupted by management alternative of compost or fertilizer and herbicides or cultivation.

4. To evaluate potential multi-year benefits from nutrient management by using enterprise budgets and tracking environmental quality parameters.

5. To establish a conceptual bridge between alternative and conventional management and to provide a sound basis for design of integrated crop systems.

This project will utilize a factorial experiment designed to separate crop integration effects. Long-term effects will be verified in long-established farmer fields, by using a paired-comparison methodology. Research will include measuring soil microbial biomass and activity, tracking soil nitrogen over time, detailed leaching studies, and an economic analysis that will factor in the costs of environmental impacts.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $93,799
Matching: $121,226

LNC93-58: ANNUAL MEDICS: A NEW LEGUME FOR SUSTAINABLE FARMING SYSTEMS IN THE MIDWEST

Major Participants:

University of Minnesota: Craig C. Sheaffer (Project Coordinator), Agronomy and Plant Genetics

Michael Fields Agricultural Institute: John Hall, Farming Systems Agronomist

Minnesota Department of Agriculture: Mary Hanks, Supervisor, Energy and Sustainable Agriculture Program

Michigan State University: Oran B. Hesterman, Associate Professor, Crop and Soil Sciences

Sustainable Farming Association of Minnesota: Tammy Keith-Wellstone, State Director

Rodale Institute: Jim Tjepkema, Midwest Coordinator

Farmers: Devin Ellinghuysen, Winona, MN; Carmen Fernholtz, Madison, MN; Robert and JoAnn Fogg, Leslie, MI; Roger French, Kalamazoo, MI; Tom Guthrie, Delton, MI; Michael Hartman, Gibbon, MN; Terry and Sheila Holsapple, Greenup, IL; Ron Keller, Faribault, MN; Roy Michaelis, Rollingstone, MN; Greg Mund, Rothbury, MI; Dale and Carmen Pangrac, Lewiston, MN; Ray Radatz, Lewiston, MN; Tim Reed, Evansville, WI; Michael Rupprecht, Lewiston MN; Dick and Sharon Thompson, Boone, IA; Alan Wood, Elkhorn, WI; Jerry Wirbel, Hope, MI; Eugene, Zins, Nicollet, MN.

ABSTRACT

Our objectives are to evaluate and promote annual medic based cropping systems as alternatives to conventional Midwest cropping systems. Annual medics are resource conserving legumes which are related to alfalfa. They have good seedling vigor and are able to fix nitrogen. Because they are annuals, they provide greater producer flexibility than perennial legumes such as alfalfa. Annual medics will be used in cropping systems to smother weeds, supply nitrogen, reduce soil erosion, and to enhance yield and quality of companion crops and pastures. Specifically, medic integration into cropping systems will result in: 1) Reduced off-farm purchases and increased energy savings from decreased use of synthetic nitrogen fertilizers and herbicides; 2) Enhancement of soil productivity and soil conservation through provision of soil cover, organic matter, and nutrient recycling; 3) Reduced herbicide use by using medic competition to "smother" weeds.

Through this project researchers will evaluate how the use of medics may reduce reliance on purchased inputs, maintain and enhance soil productivity, reduce soil erosion, and conserve energy and natural resources. The research component of this project will be conducted on-farm at multiple locations. New medic-based cropping systems will be compared to conventional cropping systems using valid experimental designs and within-field replication. Corn, small grain, asparagus, dry bean, and pasture production systems will be evaluated.

A five-state (Michigan, Minnesota, Wisconsin, Iowa and Illinois) team of producers and representatives from nonprofit sustainable agricultural organizations, state government, and university personnel will be cooperating on the project.

Objectives

1. To evaluate annual medic based cropping systems as alternatives to conventional Midwest cropping systems.

2. To develop educational programs promoting integrated cropping systems that include annual medics.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $130,000
Matching: $85,262

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Minnesota, $32,000; ($10,000)
Michael Fields Agricultural Institute, $10,000; ($3,500)
Michigan State University, $31,000; ($23,762)
Sustainable Farming Association of Minnesota, $16,000; ($35,000)
Rodale Institute, $26,000; ($6,000)

LNC93-59: BEGINNING FARMER SUSTAINABLE AGRICULTURE PROJECT

Major Participants:

Center for Rural Affairs: Wyatt Fraas, Project Coordinator; Marty Kleinschmidt, Project Research Associate; Chuck Hassebrook, Leader of the Stewardship, Technology and World Agriculture Program

Farmers:

Beginning Farm Families and other Farmers: Pat and Julie Steffen, Fordyce, NE; Laurie and Clem Wagner, Bloomfield, NE; Dave and Deb Kube, Crofton, NE; George Burkhardt, Verdigre, NE; Deb and Bill Burkhardt, Verdigre, NE; Scott Urwiler, Laurel, NE; Shelly and Hoss Hammond, Randolph, NE; Steve and ViVi Freudenberg, Madison, NE; Sophie and Kevin Ryan, Council Bluffs, IA; Doug Dittman, Raymond, NE; Marvin DeBlauw, Hartington Nebraska; Karen Tikalsky, Niobrara, NE; David and Deb Welsch, Milford, NE;

Center for Holistic Resource Management: Roland Kroos, Contracting Educator

University of Nebraska-Lincoln: Tim Powell, Agricultural Economist

Nebraska Sustainable Agriculture Society: Gary Young, President and farmer

Overview

The Beginning Farmer Sustainable Agriculture Project seeks to create a more sustainable future for agriculture by enhancing opportunities for beginning farmers to start farming using sustainable farming methods. Sustainable agriculture and beginning farmers are a natural fit. Beginning farmers are generally more open to sustainable farming than established farmers who have already made emotional, intellectual and financial commitments to conventional methods. The sustainable agricultural strategy of substituting hands-on management and skilled labor for capital and other purchased inputs offers opportunities for beginning farmers, who lack finances but have time and management ability, to build the equity needed to get started farming. Today's beginning farmers will manage a significant part of the nation's natural resource base

for the next forty to fifty years, making them a critical focus for research and education on sustainable agriculture.

Objectives

1. The project will provide educational support for six local mutual-help groups of beginning farm families organized collectively as the Beginning Farmer Support Network. The precise content of the educational program will be shaped by farmer participants but will include a range of activities focused on sustainable agriculture practices and holistic farm management, including short courses, informational workshops, construction workshops, farm tours, on-farm research and on-farm consultation with farm families.

2. The project will complete work with a subgroup of 11 case study farm families utilizing sustainable agriculture entry strategies in collecting data over a three year period on farm finances, input use, biological activity, soil and social attitudes.

3. The project will develop descriptive whole-farm case studies presenting background and data on the case study farm families and analyzing their economic and environmental performance. We will also develop decision case studies addressing key farm decisions and dilemmas.

4. The project will disseminate the findings of the project to beginning farmers, nonprofit organizations and land grant institutions through farm tours, speaking engagements, aggressive marketing of publications and educational materials, and a week long workshop on the lessons of the project for interested farmers, organizations and institutions.

This project is a cooperative effort between beginning farm families, the Center for Rural Affairs, the Center for Holistic Resource Management (CHRM), the University of Nebraska and The Nebraska Sustainable Agriculture Society (NSAS). The Center for Rural Affairs will lead the project. Wyatt Fraas of the Center serves as Project Leader. NSAS will help with the educational effort and provide support to the mutual-help groups beyond the life of the project. The University of Nebraska will take the lead in the financial analysis. CHRM will conduct workshops on holistic farm management. A special advisory committee of beginning farm families will help shape the project. A professional advisory committee will assist in planning data collection and analysis.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $109,000
Matching: $175,834

LNC93-60: SUSTAINABLE AGRICULTURE MENTOR PROGRAM

Major Participants:

University of Nebraska-Lincoln: Timothy Powell, Project Coordinator, Assistant Professor and Farm Management Specialist; Michael Lechner, Extension Agent; Leverne Barrett, Professor of Ag Leadership, Education, and Communication;

Nebraska Sustainable Agriculture Society: Sam Welsch, Executive Director;

Farmers: Lowell Schroeder, Stanton, NE;

Center for Rural Affairs: Wyatt Fraas, Project Leader, Beginning Farmer Sustainable Agriculture Project

Overview

The sustainability of the traditional agriculture production system is in question, but conversion to sustainable agriculture practices is not widespread. This bottle neck is not due to lack of sustainable practices and sustainable technology, but due to a lack of knowledge and experience by farmers in how to implement sustainable practices and technology.
Change is not easy, but transition can be less frightening if a person who has mastered a skill can teach you, and then coach you through your first steps. This is the principle of the "Mentor" program. The mentor would have the knowledge and experience in implementing sustainable agriculture practices. The focus of mentor program is to connect transitional farmers with experienced, successful sustainable agriculture farmers.

The success of the mentor program will be documented and shared with other interested parties (extension service, policy-makers, rural community leaders, sustainable agriculture organizations). This sharing will help successful programs start elsewhere by building on the successes of the program model and learning from any program failures.

The Nebraska Sustainable Agriculture Society will take the lead in recruiting and selecting prospective farm mentors who have expertise in implementing sustainable agriculture practices. Mentors will be recruited statewide. Additional input will be provided by the University of Nebraska-Lincoln and the Center for Rural Affairs to help find the farmer experts. The University of Nebraska will provide training and professional improvement education for the mentors. The Nebraska Sustainable Agriculture Society will develop a directory of mentors, their expertise, and provide the contact point to match mentors with the prospective farmer clientele. This service will be promoted in the press as well as to organizations that deal with potential farm clientele. The mentor program will target transitional farmers throughout Nebraska as the potential farmer clientele.
The University of Nebraska will be responsible for monitoring and evaluating the project, through follow-up with clients, and observation by the program coordinator. The primary purpose of this evaluation will be to make the mentors more effective. In addition,

Mentors will receive payment for their daily services and out-of-pockets expenses during the duration of the project. When this project is terminated they would continue to be available at a fee to groups or individuals needing their services.

Objectives

1. To create a mentoring program to help farm families implement agriculture practices and technology, and

2. To evaluate the mentor program and share progress with others.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $77,000
Matching: $53,000

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Nebraska-Lincoln, $21,000, ($22,000)
Nebraska Sustainable Agriculture Society, $56,000, ($15,000)
Other and Center for Rural Affairs, ($16,000)

LNC93-61: SUSTAINABLE COMMUNITY VALUES PROJECT

Major Participants:

Philadelphia Community Farm, Inc.: Verna Kragnes and Rick Hall (Project Coordinators) Co-founders;

Hamline University: Cynthia Cone, Professor and Chair of Anthropology Department;

University of Wisconsin: Larry B. Swain, Cooperative Extension Specialist; Richard Klemme, Professor, Agricultural Economics and Director of the Center for Integrated Agriculture Systems; George W. Stevenson, Sociologist and Assistant Director, Center for Integrated Agriculture Systems;

Farmers: Nathan and Beth Everett Corymb, Whitley, CO; Nora Eisland, David Huebsch; Paul Schaeffer; Dan Guenther.

Overview

Community Supported Agriculture (CSA) is a promising strategy for sharing among consumers and producers the risks and benefits of sustainable agriculture. With members paying the costs in advance, farmers can afford to use more ecologically sustainable farming practices. CSA's potential contribution to rural community development includes the creation of new opportunities for self-employment in agriculture that provide a predictable seasonal income to support small-scale farming efforts. All farms being studied involve people who have been enabled to enter farming through Community Supported Agriculture. The project will seek to document not only the "how to's" for the farmer, but also a process for educating extension agents, farm service providers and the general public about the benefits and potential problems in implementing a successful community supported agriculture venture.

The research strategy will include a mix of quantitative and qualitative methods including participant observation, in-depth interviewing, group discussion and questionnaires. Integrated descriptive case studies of the CSA farms will combine the values underlying the organization's formation with production, marketing, and financial analysis, the impacts of these farms on local communities and economies, and the attributes and satisfaction of CSA members. A pilot design

for integrated systems research will be developed during 1993-1994 that will be expanded to include additional farms in Minnesota and Wisconsin during the second year. The initial case study will be developed at Philadelphia Community Farm, Osceola, WI, building on two years of research by Dr. Cynthia Cone, Chair of Anthropology at Hamline University, St. Paul, MN. Dr. Cone continues as a principal investigator developing research protocols, supervising student researchers and evaluating the results.

The *Sustainable Community Values Project* is farmer-initiated and brings together farmers, scientists and educators in a two-year collaborative effort. Philadelphia Community Farm, Inc. operates a successful CSA demonstration project and is a participant with the Minnesota Food Association, the Land Stewardship Project and Common Harvest Farm in a CSA Task Force promoting community supported agriculture in Minnesota and Western Wisconsin.

Objectives

1. Develop decision case studies at Philadelphia Community Farm based on a whole farm analysis of production and distribution systems. Analyze management and production tasks and economic impact of CSAs on local and regional communities.

2. Determine values and organizational foundations for economic and social effectiveness of CSA.

3. Identify in what ways the establishment of community supported agriculture has or can impact other local/regional efforts for sustainable agriculture.

4. Document and demonstrate community supported agriculture to interested farmers, consumers, Cooperative Extension personnel and others.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $101,000
Matching: $140,600

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Philadelphia Community Farm, Inc., $55,800; ($65,100)
Rural Development Institute, $4,000; ($25,000)
Center for Integrated Agricultural Studies, $6,000; ($15,000)
Hamline University, $35,200, ($33,500)

LNC93-62: A BIOLOGICAL CONTROL NETWORK FOR THE SWEETCLOVER WEEVIL AND CLOVER ROOT CURCULIO

(This project also receives ACE funds, as project number ANC93-19.)

Major Participants:

University of Wisconsin: David B. Hogg (Project Coordinator) Entomology

North Dakota State University: Michael Weiss, Entomology

Michael Fields Agricultural Institute: Walter Goldstein

Northern Plains Sustainable Agriculture Society: Susanne Retka Schill, Executive Secretary

Farmers: David Podoll, Fullerton, ND; Dan Thomas, Karlsruhe, ND; Terry Jacobson, Wales, ND.

Overview

The overall goal of this project is twofold (1) to achieve a significant level of biological control of two related weevil pests, the sweetclover weevil *(Sitona cylindricollis)* and the clover root curculio *(Sitona hispidulus)* in the North Central Region, and (2) to involve farmers in learning how to work with and disseminate the natural enemies to be used as biological control agents.

These *Sitona* weevils are pests in two different cropping systems. The sweetclover weevil is a major pest of yellow sweetclover, *Melilotus officinalis*. Feeding by the adult weevil causes periodic and extensive stand reductions and even complete stand loss of sweetclover. Yellow sweetclover is a cold hardy, drought tolerant and cost effective biennial legume that is used both as a forage and source of organic nitrogen in the Northern Great Plains. Because there is no suitable substitute with similar attributes as sweetclover, loss of this crop due to the sweetclover weevil would cause serious difficulties for farmers attempting to maintain sustainable rotations.

The clover root curculio, despite its name, is primarily a pest of alfalfa, *Medicago sativa*, in the U.S. In this case it is feeding of the weevil larvae on alfalfa roots that damages the crop, and though less obvious, this damage is a significant contributor to premature alfalfa stand loss throughout the North Central Region. Alfalfa is generally recognized as the most important forage legume in the North Central Region. Although the clover root curculio does not pose the same threat to alfalfa that the sweetclover weevil poses to sweetclover, reduction of clover root curculio populations would result in a substantial improvement in alfalfa longevity and productivity.

In North Dakota, three farmers will be directly involved with NDSU entomologists in conducting the field component of the project, and in the process they will learn the basics of biological control. In Wisconsin, the field component will be conducted by UW entomologists in collaboration with Michael Fields Agricultural Institute scientists.

Objectives

1. Receive parasitoids of *Sitona* from Siberia and Moldova.

2. Raise the parasitoids in laboratory cultures and conduct studies to ascertain their behavior, host range and potential effectiveness as biological control agents.

3. Make controlled parasitoid releases in field cages at selected sites in North Dakota and Wisconsin.

4. Make open field parasitoid releases.

5. Provide selected farmers with a working knowledge of biological control in the sweetclover - *Sitona* - parasitoids system, including major farmer responsibility for the field cage releases, and encourage long term maintenance of the program through farmer networks.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $58,551
Matching: $31,202

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Wisconsin, $23,000, ($22,702)
North Dakota State University, $21,449, ($6,500)
Michael Fields Agriculture Institute, $14,000, $2,000

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*The SARE Low-Input Sustainable Agriculture and the Agriculture in Concert with the Environment programs share funding for this project.

PART III. ACE PROJECTS FUNDED, 1991 TO 1993

Table of Contents of Part III

The following are descriptions of all the North Central ACE projects funded from 1991 to 1993, including results from the progress reports received in 1992.

ANC91-1: WILDLIFE USE OF EXPERIMENTAL INTERCROPPING SYSTEMS

Project Coordinator:

Louis B. Best, Iowa State University, Department of Animal Ecology, 124 Sciences II
Ames, Iowa 50011

Major Participants

Heidi Stallman, Graduate Student Assistant, Department of Animal Ecology, Iowa State University

Farmers: Mike Richerts and Tom Frantzen

Overview

Wildlife use of and productivity in agricultural cropping systems is poorly documented, particularly for nongame species. Some agricultural habitats are known to be "ecological traps," where bird productivity is too low to sustain viable populations. Some new initiatives in sustainable agriculture, such as strip intercropping, hold promise of improving habitat conditions for wildlife in agroecosystems. The objectives of the proposed research are to: (1) document bird and small-mammal abundances and species composition in an experimental strip intercropping system, (2) determine preferential use of various crop strips by birds and mammals and the importance of crop-strip configuration, and (3) assess avian nesting success and productivity in the strip intercropping system. The proposed research is part of a multidisciplinary effort to find systems that are more environmentally sustainable but as economically favorable as current conventional farming systems. The target audience for such research findings will include wildlife ecologists and managers, private farm operators, and agricultural extension specialists.

The research will be conducted for two years on two privately owned farms. Two study plots (fields) will be located on each farm. Bird use of the strip intercropping system will be evaluated by using two techniques. Transect censuses will be conducted along cropping strips and will cover the entire study plots to provide estimates of bird abundance. Observations made from portable tower-blinds (three per field) will provide information on relative use of the various intercropping strips by each bird species. Small-mammal abundance will be assessed within three sample grids per field, and the small mammals will be captured within the grids by using snap traps. Nest searches will be conducted on fields twice during the breeding season, and all located nests will be monitored to determine their outcome.

Objectives

The goals of this project are 1) to document the abundance and species composition of birds and small mammals in an experimental intercropping system using row crops, legumes, and small grains; 2) to determine preferential use of various crop strips by birds and mammals and the importance of crop strip configuration; and 3) to assess avian nesting success and productivity in the intercropping system.

Progress to Date

The pilot study completed during the summer of 1991 revealed interesting spacial and temporal movements of small mammals in strip intercropping systems. These results suggested a change from the originally proposed snap traps to Sherman live traps. Two sampling grids were randomly placed in each study plot, and mammals were trapped once in June and again after oat harvest. The small-mammal sample grids were arranged so that differential use of the various intercropping strips could be quantified and evaluated. Preliminary trapping results indicated that small-mammal species diversity is low. In the first trappings of 1992, deer mice, house mice and a short-tailed shrew were caught. Of these, 27% of deer mice were captured in corn strips, 65% in oat strips, and 8% in soybean strips. In the next trapping, about 30% of deer mice were caught in the corn strips, 64% were caught in the soybean strips, and about 7% were in the oat strips, confirming the movement patterns observed in the 1991 pilot study.

Unlike the situation with small mammals, bird species diversity was found to be high in these intercropping systems. Thirty-one species were identified with vesper sparrows, brown-headed cowbirds and horned larks being most abundant. Nineteen vesper sparrow nests were found, including one nest of fledgling young. The remaining nests failed because of cultivation activities (47%), desertion (26%), and predation (21%). About 63% of the nests were parasitized by brown-headed cowbirds. The data suggested low vesper sparrow productivity in strip intercropping systems.

Project Duration: Sept. 1, 1991-Aug. 31, 1993
Funding: $39,100
Non-Federal Matching: $39,040

ANC91-2: FARMER-TO-FARMER MENTORSHIP AND INNOVATIVE ON-FARM RESEARCH

Project Coordinator:

Ben Stinner
Ohio Agricultural Research and Development Center
Ohio State University
OARDC
Wooster, Ohio 44691

Major Participant:

Kamyar Enshayan
Sustainable Agriculture Program
1735 Neil Avenue
Columbus, OH 43210
614-292-3786

Progress Report

The project sponsored workshops to bring together farmers, university researchers, extension staff, SCS and other agricultural organizations to plan and conduct programs they identified as important. Participating farmers said these workshops helped them connect with other farmers and resource people, realize that they were not alone and that soil restoration, resource conservation and economic profitability are viable possibilities for many farmers. These workshops reaffirmed the project coordinators' assumptions that: 1) farmers are innovators; 2) farmers have valuable knowledge and experiences which can be helpful to others; 3) university generated test-plot information and whole-farm knowledge are both valuable and complement each other, and 4) farmers and educators alike can learn from one another. Five major farmer-to-farmer workshops were held, attracting more than 1,000 producers. Six farm tours attracted another 1,000 people.

Project participants now are developing a bulletin for on-farm research and simple statistical methods for farmer experimentation and are forming a network of farmers (Innovative Farmers of Ohio) who are experimenting on their farms.

Project Duration: Sept. 1, 1991-Aug. 31, 1993

Funding to Date:
SARE/ACE: $57,500
Non-Federal Matching Fund: $109,812
Federal Matching Fund: $12,000

ANC91-3: PROVEN SUSTAINABLE PRACTICES FROM NEBRASKA FARMERS

Project Coordinator:

Charles Francis, University of Nebraska, 219 Keim Hall, Department of Agronomy
Lincoln, NE 68583-0910

Major Participants:

Kevin Berhardt, Graduate Research Assistant, Department of Agronomy, University of Nebraska, Lincoln, NE 68583-0910

Overview

A book describing at least 100 of the innovative sustainable agriculture practices being used by Nebraska farmers is being prepared, based on field research, surveys and interviews conducted with producers. It will cover a range of practices envisioned, tested and put into full scale use by farmers across the state. These include efficient ways to provide fertility and pest management for cropping systems, rotation designs, crop-animal integration into profitable farm enterprises, and long-term planning for a desirable farm landscape. Researchers have found that there is much more long-term thinking, at least with the producers interviewed, than they had anticipated.

Fact sheets, which will be compiled for the book, are currently being written. They describe the practice, how it fits into the entire farm system, the economics of the practice or system compared to conventional practices in the area, effects of farm programs where appropriate, and environmental impact of the practice. The fact sheets will be designed so Extension personnel or researchers can use them to answer specific questions on sustainable agriculture practices.

Project Duration: Sept. 1, 1991-Aug. 31, 1992; Extension granted until June 30, 1993
Funding: $25,000
Non Federal Matching: $25,000

ANC91-4: INFLUENCE OF CROPPING SYSTEMS ON CONTAMINATION OF A SHALLOW AQUIFER IN THE NORTHERN GREAT PLAINS

Project Coordinator:

David L. Klinkebiel, Research Agronomist, North Dakota State University, Carrington Research Extension Center, Box 219, Carrington, ND 58421. Phone: 701-652-2951

Overview

In the Northern Great Plains, two general philosophies seem to be surfacing as to what is perceived as sustainable. One philosophy, the "Integrated Input" approach, perceives that sustainability can be achieved if purchased inputs are more selective and are used more timely, efficiently, and economically. Coupling these practices with methods to reduce soil erosion and decrease environmental degradation results in a combined approach that is broadly described as "sustainable". The other philosophy, here defined as a "Biological" cropping system, perceives that long term economic and environmental sustainability can be achieved with greater use of non-purchased inputs. Virtually all inputs are supplied biologically. By properly selecting crops and rotations, soil fertility renewal and pests are biotically managed, thereby reducing or eliminating the need to buy purchased inputs. Currently, each practice is using a different set of inputs to maintain similar levels of production. Both of these ideas are currently being practiced on many farms with the number of acres continuing to increase.

The objectives of this project are to examine a "Conventional", "Integrated Input", and

"Biological" cropping system based on production, economic cost and benefits, and the influence these systems will have on the environmental integrity (pesticide and nitrate contamination) of a shallow aquifer. By involving farmers in the decision processes on the inputs and cropping practices, they will have the chance to get involved with the project in a role other than the recipient of the final information. This educational tool and experiment will be located directly on the Carrington Research Extension Center in the central part of North Dakota. Because of the location of the center, interaction between area farmers and research/extension staff is strong. This is a joint project between farmers, extension, and researchers from North Dakota State University and North Dakota Water Commission. The information will be used to better inform producers, extension, and researchers of the

Abstract of Progress to Date

In the fall of 1991, plots were established at the Carrington Research Extension Center directly over the shallow Carrington Aquifer. That same fall, unsaturated water sampling lysimeters were placed at the 2 m depth on all 12 plots. Sampling wells were drilled and well screens were placed at the water table. Undisturbed core samples were taken at positions approximately 50 radial centimeters from each neutron probe access tube at the 122 to 150 cm depth for determination of laboratory water retention curves and saturated and unsaturated hydraulic conductivity. At least two sets of replicate samples were taken at different topologic positions on the described radius. On soils with large spatial heterogeneity of soils at the 122 to 150 cm depth, an additional set of samples was taken at the 107 to 122 cm depth. All laboratory hydraulic properties have been measured and field hydrologic data is currently being analyzed.

Saturated till and Carrington aquifer water levels have been measured monthly on two replicate sets of piezometers, placed at the east and west ends of the experimental field since the beginning of the field season. Initial soil samples were taken in the fall of 1991 to establish nitrogen levels to a depth of 9 feet. Nitrate spikes were found to exist at depths below normal rooting zones. Not every plot possessed the nitrate spike. This finding is probably the result of variability in active and non-active recharge sites which are caused by differences in microtopography.

Initial soil physical properties were analyzed so that treatment effects over time could be determined. Most soil physical characteristics are similar among the different cropping systems. This would be expected since the previous cropping system was fairly uniform across this test area prior to establishing the plots. Not all initial soil analyses are completed at this date. Light fraction organic matter, soil textural analysis, nitrate, ammonium, water content, soil water pesticide, nitrate, and ammonium are still being determined.

Preliminary findings after the first year would indicate that most soil physical characteristics are similar among the different cropping systems. This would be expected since the previous cropping system was fairly uniform across this test area prior to establishing the plots. Two differences were found to exist among the measured soil factors. The Ph at the 30-60 cm depths differed between the conventional plots and the integrated and biological plots which were the same. No conclusion can be drawn from this finding other than the result of random variation between plots. The percent aggregate soil particle size between 0.5 and 0.25 mm was similar between the conventional and integrated plots but differed in the biological plots. The samples for this analysis were taken when the wheat was finishing pollination and some of

the treatments had already been applied. Perhaps rotary hoeing the biological plots resulted in some of the larger sized aggregates to be broken down into the 0.5 to 0.25 mm size class.

Since one full season has not been completed, results on other agronomic characters such as yield and yield components, biomass, plant tissue analysis, residue cover, and a complete economic analysis can not be determined at this point.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $63,000
Non-Federal Matching: $63,005

ANC91-5: A NATIONAL CONFERENCE ON PARTICIPATORY RESEARCH AND EDUCATION FOR AGRICULTURAL SUSTAINABILITY

Project Coordinator:

New Project Coordinator: Robert Hornbaker, Dept. of Agricultural Economics, University of Illinois, 431 Mumford Hall, 1301 W. Gregory Dr., Urbana, IL 61801. Phone: 217-333-5508

Previous Project Coordinator: John Gerber, Assistant Director, University of Illinois, Agricultural Experiment Station, 1301 W. Gregory Dr., Urbana, IL 61801. Phone: 217-244-4232

Major Participants:

Donald Holt, past president, Agricultural Research Institute, 9650 Rockville Pike, Bethesda, MD 20814. Phone: 301-530-7122

Jan King, president, Illinois Stewardship Alliance, RR 1, Box 138, Knoxville, IL 61488. Phone: 309-289-4770.

Abstract of Progress/Final Report

While agricultural research and education were once the near-exclusive domain of state and federal organizations and product-based companies, many non-profit and community-based groups are now involved. Many of these new programs are directed by farmers, and much of this activity occurs on farmers fields in real-world situations. In fact, the availability of federal grants from the Sustainable Agriculture Research and Education Program has encouraged this activity. Concurrent with the increase in on-farm research and demonstrations has been a growing interest in the methodology, credibility, and impact of this approach.

Through this project, a national three-day conference was held in Champaign, Ill., to explore these questions and allow participants to share experiences related to participatory on-farm research and education models. Approximately 180 farmers, industry representatives, government agency workers, educators and researchers registered for the conference. In addition, about 150 members of the American Society of Agronomy participated during the first day of the meeting which was organized as a joint educational session. It was held in conjunction with

the North Central Regional Meeting of the American Society of Agronomy and the annual meeting of the North Central Regional Research Committee, NCR-157, Evaluating Sustainable Agriculture Production and Marketing Systems.

This conference provided for improved awareness and understanding of how the participatory model can be used to develop new knowledge through research, and how to share that knowledge with a wider community through effective education programs. Conference participants were extension educators, applied research scientists working with sustainable agriculture groups, the farmer leadership of sustainable agriculture organizations, crop and pest management consultants, and research and development personnel from agricultural industry.

A 249-page proceedings was published and is also available in electronic form on the Sustainable Agriculture Network

Other sponsors of the conference were the Agricultural Research Institute, the Illinois Stewardship Alliance, and the University of Illinois.

Duration Period: Sept. 1, 1991-Aug. 31, 1992

Funding: $10,000
Non-federal Matching: $34,200
Federal Matching: $12,500

ANC91-6: WHOLE-FARM NUTRIENT AND AGCHEMICAL INPUT BUDGETING FOR SUSTAINABLE FARMING: ANALYSIS AND DEMONSTRATION

Project Coordinator:

Jeffrey Wyman, Department of Entomology, College of Agricultural and Life Sciences (CALS), University of Wisconsin-Madison, 1630 Linden Dr., Madison, WI 53706
Phone: 608-262-3229

Major Participants:

Larry K. Binning, Weed Scientist, Department of Horticulture, University of Wisconsin-Madison

Larry Bundy, Soil Fertility Specialist, Department of Soil Science, University of Wisconsin-Madison

Fred Madison, Soil Scientist, Wisconsin Geological and Natural History Survey

Peter Nowak, Department of Rural Sociology, University of Wisconsin-Madison

John and Annette Guttman, Farmers, Ozaukee County, Wisconsin

Steve and Cheryl Mergen, Farmers, Grant County, Wisconsin

University of Wisconsin-Extension:
Richard Proost, NPM Southeast Regional Specialist
Karen Talarczyk, NPM Southwest Regional Specialist
Laura Ward Good, NPM Soils Outreach Specialist
Kit Schmidt, NPM Pesticide Outreach Specialist

Polly Erickson, NPM Ag Economist

Robin Sheperd, Graduate Student, Land Resources Program, University of Wisconsin-Madison

Overview

Three Wisconsin dairy farms have been identified as partners in a project designed to develop and evaluate a whole-farm systems approach to sustainable nutrient and pest management. These three farms are representative of the range of dairy operations in the state in size and complexity. In concert with specialists from the Nutrient and Pest Management (NPM) program of the University of Wisconsin-Extension, participating farmers will identify nutrient inputs and pest management strategies. Farmer/researcher teams will then devise whole-farm management strategies to minimize inputs and effectively utilize indigenous nutrient sources and on-farm resources for controlling pest problems.

The efficacy of cooperatively developed whole-farm nutrient and pest management strategies will be evaluated as they are implemented on the participating farms. Emphasis will be placed on profitability and practicality for participating farmers as well as protection on soil, surface water, and groundwater resources.

Abstract of Progress to Date

This project is exploring how specific sustainable agriculture management practices can be extended to a whole-farm dairy system. Whole-farm nutrient and agrichemical budgeting was conducted in 1992 for the three original Wisconsin dairy farms being studied. The project has been expanded, with additional funding from the Center for Integrated Agricultural Systems, University of Wisconsin, to include a fourth farm for analysis and demonstration. The fourth farm uses a rotational grazing herd management strategy. Baseline data on crop nutrient status and current weed and crop pest status were collected during the first year. Data included soil tests of every field, crop production inputs (both purchased and farm derived); equipment used for harvest, seedbed preparation, planting, cultivation and agrichemical application; time spent on farm operations; and first and second harvest forage yields and quality. Crop consultants were hired and a record made of plant populations, insect populations and weed species and pressure. Farms of similar type (match farms) are being identified for comparison and evaluation.

Using this information, management plans for each farm are being developed to maximize profitability and sustainability. Cooperating farmers, Nutrient and Pest Management Program staff, and farmers experienced with sustainable agriculture management practices are working together to develop 1993 management plans. Plans for two of the farms will use low, medium and high input management schemes. Information on the crop nutrient and pest status of the farms will continue to be collected and economic factors involved in farm operation will be monitored in 1993.

Project Duration: Two years, ending Aug. 31, 1993
Funding to Date: $85,000
Non-federal Matching: $85,000

ANC91-7: SUSTAINABLE AGRICULTURE: TEACHING YOUTH AND TEACHERS

Project Coordinator:

Derrick N. Exner, Extension PFI Coordinator, Practical Farmers of Iowa, 2104 Agronomy Hall, Iowa State University, Ames, IA 50011 Phone: 515-294-1923

Major participants:

Practical Farmers of Iowa, Gary Huber, 2104 Agronomy Hall, Iowa State University Ames, IA 50011. Phone: 515-294-8512

Iowa State University

Cooperators:

ISU Agriculture Education and Studies Department
ISU Extension Youth and 4-H Program
Iowa Future Farmers of America (FFA) Foundation
Iowa Association of Soil and Water Conservation District Commissioners
Iowa Young Farmers Educational Association
Iowa Department of Education

Overview

It would be beneficial for Iowa's youth and teachers to learn how sustainable practices work and why they are important. Practical Farmers of Iowa (PFI), a non-profit association of farmers that works to generate and share new information on profitable and environmentally sound farming practices, joined with Iowa State University in a cooperative project to address this need. With a goal of increasing the adoption of sustainable practices in Iowa, the project works with other organizations to educate teachers and youth on sustainable agriculture topics. Teachers learn through the development of sustainable agriculture curriculum materials and in-service training on sustainable agriculture topics. Youth learn from hands-on experiences with sustainable agriculture practices through FFA chapters, high school agriculture classes, demonstrations at the Iowa 4-H Education and Natural Resources Center, and sustainable agriculture projects guided by farmer mentors. The project also includes a pre- and post-test evaluation of the attitudes and knowledge levels of teachers and youth on sustainable agriculture topics.

Objectives

1. Familiarize teachers and youth leaders with sustainable agriculture concepts and techniques.

2. Enable young people to learn about sustainable agriculture practices and concepts.

3. Demonstrate to teachers and students the farmer-scientist collaborative model.

Results

The main educational activities of the project's first year and plans for the second year are described below:

1. Through this project, the ISU Agriculture Education and Studies Department and the Iowa FFA Foundation developed sustainable agriculture curriculum materials for high school agriculture teachers titled "Sustainable Agriculture Field and Laboratory Exercises." In the project's second year data from PFI on-farm research trials will be used to expand curriculum materials to include economic comparisons of sustainable and conventional practices. Teachers wanted the additional comparisons to show how alternative practices compared favorably with conventional practices in terms of profits.

2. The project worked with the ISU Agriculture Education and Studies Department to conduct 12 in-service training sessions on sustainable agriculture for agriculture teachers. Eighteen teachers attended one session which combined sustainable agriculture topics with training on how to use case studies to teach problem-solving skills. These teachers then helped conduct six in-service sessions on farms of PFI members across Iowa, with 80 additional teachers attending. Eight teachers attended an in-service session held as part of a regional FFA conference, and 22 teachers attended four sessions that were held as part of a statewide agri-science fair. During the second year additional in-service training sessions will be held. The format will involve bringing PFI farmers and agriculture teachers in for evening sessions at high schools, with each farmer discussing a different sustainable agriculture topic.

3. Help agriculture teachers and students use PFI's on-farm research methods to evaluate sustainable agriculture practices. The project recruited and helped an agriculture teacher and the local FFA chapter use PFI's on-farm research methods to conduct a research trial on land next to the local fairgrounds. The trial compared corn yields where the nitrogen rate applied was based on traditional recommendations with yields where the nitrogen rate applied was based on results of the late spring soil nitrate test. In addition, the project surveyed all high school agriculture teachers during its first year, and 29 were very interested in using PFI's on-farm research methods to evaluate sustainable agriculture practices. These teachers will be contacted during the project's second year, and those wanting to proceed will be assisted.

4. Demonstrate sustainable practices at the Iowa 4-H Education and Natural Resources Center. The 4-H Center's long range plan calls for switching 150 acres of cropland from conventional to sustainable agriculture practices, and then using these practices to teach the 9,000 youth and adults who use the Center each year about sustainable agriculture. This ACE project is helping the Center reach this objective. Several sustainable agriculture practices were implemented in the project's first year, including switching 50 acres to ridge tillage, installing

a one-acre narrow strip intercropping demonstration, and using late spring soil nitrate tests to assess the corn's nitrogen needs. A summer intern was hired and trained to lead youth on tours of the practices. In the project's second year these sustainable agriculture practices will be continued. A research trial on nitrogen rates will be added, and a researcher with the National Soil Tilth Lab will begin using the Center for a study examining earthworm populations over a time period when tillage systems are being changed. Additionally, the youth tours of the sustainable agriculture practices will be improved based on the project's first-year experiences.

5. Organize visits of PFI farms by youth groups. PFI farmers willing to host youth tours and youth field days were identified in the project's first year. Special youth field days are planned for the project's second year. Youth tours will be facilitated by a brochure that will be distributed to 4-H specialists and agriculture teachers that says, "These are farms you can tour, these are the sustainable agriculture practices you can see, and this is how to set up a tour."

6. Conduct a youth mentoring program. A mentoring program taps the skills and knowledge of PFI members and Soil & Water Conservation District Commissioners by linking them with youth in one-on-one relationships centered around sustainable agriculture projects. Over 100 District Commissioners and PFI members were asked about their willingness to serve as mentors, and 34 agreed to participate. Agriculture teachers and 4-H specialists in the communities of these District Commissioners and PFI members were approached to help recruit youth to pair with the adults. Eight youth were identified, and meetings were held with these youth, the youth's parents, and the mentors to create individual "development plans" for the youth. Additional pairings were possible, but finding willing youth was difficult. The mentoring program will be continued and expanded to include more youth in the project's second year.

7. Provide program assistance to the Iowa Young Farmer Educational Association. The Iowa Young Farmer Educational Association (IYFEA) is a key group for the education project because membership is limited to farmers under 40, and its purpose is to provide educational opportunities for young farmers. Several educational events were conducted for its members. A PFI cooperator spoke on intensive rotational grazing to 20 members of a local YFEA chapter, and 35 YFEA members visited a PFI cooperator's farm as part of the IYFEA's winter institute. These events will be expanded in the second year to include, among other things, summer tours of the farms of PFI farmer-researchers.

Project Duration: Two years, ending Aug. 31, 1993
Funding: $38,550
Non-federal Matching: $108,965

ANC91-8: SUSTAINABLE AGRICULTURE TRAINING AND SUPPORT FOR HIGH SCHOOL AGRICULTURE INSTRUCTORS

Project Coordinator:

New Project Coordinator: Robert Meyer, Wisconsin Rural Development Center, 1406 Business Highway, 18/151 East, Mount Horeb, WI 53572. Phone: 608-437-5971

Previous Project Coordinator: Robert Panzer, Wisconsin Rural Development Center, 1406 Business Highway, 18/151 East, Mount Horeb, WI 53572. Phone: 608-437-5971

Major Participants:

Wisconsin Rural Development Center
Robert Meyer, project and curriculum coordinator
Margaret Krome, program director

Abstract of Progress to Date

Through this project, high school agriculture teachers were trained in sustainable agriculture concepts at the Summer Course at UW-River Falls and at eight Cooperative Extension Service workshops. The summer course was combined with the Wisconsin Association of Vocational Agriculture Instructors (WAVAI) summer conference, allowing attendants to earn college credit at the two-day workshop. In addition, about 150 students attended presentations by sustainable farmers at three Future Farmers of America workshops.

Continuation of the Discovery Grants program has been another outcome of this project. In this program, small grants from local businesses and organizations were competitively awarded to schools which developed small sustainable agriculture projects. For example, one high school studied the effect of no- and low-rate herbicide production of corn with the help of a local farmer. In another case, students learned how to produce and market wildflowers and prairie grass as an alternative crop.

The attendance at the various workshops was lower than expected and caused project researchers to reevaluate the target, scope and audience of the project to consider a broader and more interdisciplinary approach to teacher involvement in the future.

Project Duration: One year, ending Aug. 31, 1992
Funding: $38,900
Non-federal Matching: $44,650

ANC91-9: REDUCED CHEMICAL INPUT PRODUCTION OF PEACH

Major Participants:

Michigan State University: Dr. James A. Flore, (Project Coordinator), Professor, Department of Horticulture, East Lansing, MI 48824-1325

Dr. William Shane, District Horticultural Agent, Southwest Michigan Research and Extension Center, Benton Harbor, MI 49022

Mr. Gary Thorton, Berrien County Horticultural Agent, 5060 St. Joseph Avenue, Stevensville, MI 49127-1046

John Wise (On-Site Project Coordinator), Research Associate, Trevor Nickles Research Complex; Rt. 4, 6227 M-89; Fenville, MI 49408

Participating Farmer:

Jerry Jollay, grower and president of Michigan Peach Sponsors, 1850 Friday Road, Coloma, MI 49038

Overview

Synthetic chemical inputs for peach production in Michigan and the North Central regions of the United States have risen steadily since the turn of the century. It has been increasingly difficult for growers to control certain insects and disease problems through conventional means, and the market place is calling for more and more fresh product to be grown in a reduced chemical environment. This project brings together science and education from horticulture, entomology, pesticide research, weed science and the Cooperative Extension Service with representatives from grower organizations to reduce crop chemical dependency (pesticides, herbicides, and fertilizer) for peaches. The project compares chemical residues in groundwater and in fruit for conventional, moderate IPM, and low IPM under Michigan commercial conditions at the new Southwest Michigan Research and Extension Center, where its mission is direct outreach to growers and consumers.

The project is being carried out in three phases: (1) establishment of different orchard systems at Southwest Michigan Research and Extension Center (SWMREC), currently being funded by the Michigan Agricultural Experiment Station and planted in 1990; (2) educational programs for growers concerning the effectiveness and incorporation of these techniques into grower operations (funding requested by ACE); and (3) monitoring of pesticide and fertilizer residues in fruit (currently being funded by Michigan Agricultural Experiment Station), and groundwater (funding requested from ACE).

Objectives

(1) To integrate IPM technologies (fertilizer and nutrition, ground cover management, insect and disease control and horticultural practices) into orchard systems and compare them with conventional systems.

(2) To demonstrate to growers the effectiveness of these systems.

(3) To reduce pesticide and fertilizer inputs into the system.

(4) To monitor groundwater and fruit residues to determine the effect of these systems on contamination.

Results

During the first year researchers reduced the number of insecticide applications for moderate input treatments by two and for low input treatments by six, when compared with the control. Synthetic fungicide applications were reduced by five and seven, respectively, by applying sulfur to these plots. Weeds were controlled in the low input treatment with straw mulch. In the moderate input treatment, chemical fertilizer was reduced by half, and in the low input treatment horse manure were used in place of chemical fertilizer.

Yields in 1992 ranged from 5-9 kg per tree, but were not significantly different for the different treatments. From an entomological point of view, the conventional treatment had 96.5 percent clean fruit versus 89.75 percent for the moderate input and 81.75 for the low input. Endophytic rye was effective in reducing Tarnish Plant Bug and leafhopper populations in the low input treatment, and oriental fruit moth disruption was also effective in these plots. It was noted that rose chafer (a secondary pest) became a problem in the nonconventional plots.

Through the second growing year, there were no significant differences in winter hardiness, tree growth, leaf nitrogen, ground water nitrate contamination, or triazine residue due to the different treatments. The 1992 crop residues have not yet been analyzed.

The case studies are not on commercial farms, however, the six 1-acre test blocks (two for each treatment) are on the Southwest Michigan Research and Extension Center, which is open to all growers and is in the center of the Michigan fresh peach industry.

Approximately 100 producers attended workshops and 130 producers attended field days related to this project.

Project Duration: Two years
Funding: $40,000
Matching Non-Federal: $64,000

ANC92-10: WHOLE-FARM ECONOMIC ANALYSIS OF MEDIUM-SIZED, SINGLE-FAMILY DAIRY FARMS THAT DIFFER IN THEIR USE OF PURCHASED CHEMICAL INPUTS (Formerly LNC88-12)

Major Participants:

Wisconsin Rural Development Center: Marvin Kamp (Project Coordinator); Margaret Krome, Sustainable Agriculture Program

University of Wisconsin-Madison: Richard Klemme (Project Coordinator), Agricultural Economics; Mark Dietrich, Land Resource Management

University of Wisconsin-River Falls: Stan Schraufnagel, Agricultural Economics

Farmers: Forty-five Wisconsin dairy farmers

Overview and Objectives

Over the past year, low commodity prices, restrictions on herbicide use, and individual as well as public health and environmental concerns, have combined to generate increased interest in alternative non-chemical methods of crop and livestock production. Producers who routinely use pesticides and inorganic fertilizers, however, are concerned about increased economic risk if they substitute non-chemical methods to control pests and provide soil fertility. Producers often face two major obstacles in reducing chemical use: a lack of available, farm-level information on techniques and methods and, perhaps more important, a source of reliable data on the economic impacts of non-chemical alternatives. This study will address these concerns by:

1. accumulating detailed economic data on 45 participating farms;

2. conducting comparative analysis of 45 participating farms, grouped by their use of pesticides and purchased fertilizers;

3. generating annual whole-farm economic analysis of each individual farm; and

4. facilitating the exchange of information and ideas among farmers and between farmers, lenders, researchers, suppliers, and agricultural agencies.

This cooperative interagency research study has successfully undertaken three years of economic analysis on the impacts of various levels of agricultural chemical use and seeks funding for a fourth and final year. Preliminary results suggest that there are definite economic advantages to reduced chemical use. Particularly given the extremes of climate and market conditions over the three years of existing data and the need for long-term study of alternative practices, a fourth year will help provide a basis upon which to draw more reliable conclusions of the economic implications of routine - chemical, low-chemical, and no-chemical production methods.

This project will continue to document the early costs and returns of the study's 45 medium-sized Wisconsin dairy farms and provide detailed information on an enterprise-by-enterprise and whole-farm basis as well as conduct comparative analyses across the three chemical use groups. For each crop and livestock enterprise on each farm, previously developed data gathering and analysis methodology will document the amounts and costs of all inputs used, production levels and yields, labor, fuel use, machinery and capital requirements as well as debt servicing requirements and capacity.

Agricultural economists from the University of Wisconsin-Madison and River Falls and WRDC staff will continue to advise and assist in project analysis and presentations. Perhaps more important, however, is the role played by the participating farmers in advising on content and relevance of the data collected. It is through listening and responding to the concerns and needs of the participants that the project achieves its ultimate objective -- to assist in determining management and production methods which enhance the economic viability of the family-sized farm.

In addition to the detailed economic study of these farms, beginning in 1992 and continuing into 1993, case-studies and individual profiles of select farms will be conducted in order to identify key production and management strategies and alternative techniques. Study

results indicate that reductions in chemical use are accompanied by other management changes and include a wider range of economic and technological production decisions. Changes in crop rotation sequences, on-farm nitrogen use, livestock management, capital investments, labor requirements, and adaptations to alternative techniques used by economically successful farms indicate several underlying differences among chemical use groups. Such information, along with the individual economic data already collected, will provide a clearer model for identifying management strategies and enable participating farmers to make more informed management decision.

Outreach is key to this project's success. The project coordinator will continue to conduct field days, meetings, and workshops for participating farmers, non-profits, and UW faculty to exchange ideas and information about cost-cutting, chemical-reducing techniques. These settings will provide an opportunity to extend the project's findings to other farmers, extension agents, researchers, the press, and others. In addition, eight smaller "kitchen table" meetings with project farmers will be held each year to facilitate discussion and allow for individual consultation and analysis of results.

The project's preliminary results have generated considerable interest, both in Wisconsin and nationally. The three years of data already collected indicate that, at least in the short-run, there are economic benefits of reduced chemical use. One more year of data collection will strengthen the project's usefulness and validity -- both in terms of increasing farm-level economic viability and in addressing the concerns of a growing public awareness of environmental issues. By this project's efforts to increase this awareness and involve researchers, extension agents, lenders, and agricultural leaders, it is hoped that an institutional climate may be created which provides a more secure future for family-sized agriculture in Wisconsin and elsewhere.

Project duration: One year, ending Aug. 31, 1993
Funding: $68,230

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Wisconsin Rural Development Center, $51,430, ($6,300)
University of Wisconsin-Madison, $12,750, ($15,050)
University of Wisconsin-River Falls, $4,050, ($11,000)
Wisconsin Department of Agriculture and Consumer Protection (DATCP), ($36,400)

ANC92-11: IMPACTS OF AGRICULTURAL MANAGEMENT SYSTEMS ON ECONOMIC, ENVIRONMENTAL, AND WILDLIFE VALUES OF ALTERED AND UNALTERED WETLAND AREAS

Major Participants:

South Dakota State University: Diane H. Rickerl (Project Coordinator), Plant Science; Daniel E. Hubbard, Wildlife Management; Larry Janssen, Ag Economics; Bruce H. Bleakley, Soil Microbiology;

Farmers: Chris and Laurie Johnke, Madison, SD; Charlie and Betty Johnson Madison, SD; Tom and Joan Wolles, Colton, SD;

Objectives

Interest in wetlands has long been part of wildlife management, but because of Swampbuster provisions of the Farm Bill and because of the role of wetlands in removing contaminants from water, interest in wetlands has peaked. This interdiscipline, interagency proposal integrates six major objectives.

1. To research the impact of farm production systems on avian populations, food supplies and habitat diversity of altered and unaltered wetland and upland tracts.

2. To determine the effects of farm production systems on the water balance of altered and unaltered sites, between wetland and upland agricultural tracts.

3. To determine the effects of farm production systems on the water quality of wetlands and ground water.

4. To estimate production costs and net returns of major farm production systems adapted to the selected field tracts.

5. To compare selected economic and environmental trade-offs between major farm production systems.

6. To develop holistic packages of information and an improved network for exchange of information concerning the effects of management on wetland values.

Methodology

Three farms in the Prairie Pothole Region of eastern South Dakota will be used fur comparison of "organic, low-input, and conventional" farm production systems. Maps, ASCS/SCS records, discussions, and site visits will be used to select wetlands. Tracts with an approximate duplicate will be used, so that statistical analyses can be conducted. To be considered duplicates, tracts must be similar in wetland classification and ground water function, and in upland management system. A minimum of 12 and maximum of 24 tracts will be selected. The proposed project will be conducted in conjunction with two Hatch projects recently initiated at South Dakota State University. Brief outlines of methods are listed for each objective.

1. In order to compare the distribution and abundance of avian and plant resources of the three farm production systems, populations from both wetland and upland tracts will be determined. Breeding birds of upland avian communities will be censured from mid-June through mid-July, as these are the times that most local breeding birds are on territories. Breeding-pair counts of waterfowl communities will be conducted on wetlands within and fields adjacent to selected tracts. Waterfowl broods will be indexed using flushes of broody hens if the available semipermanent wetlands are filled with solid stands of emergent vegetation or a walk-wade technique if stands die out due to high water. Aquatic invertebrates and soil weed seed populations, as avian food supplies, will be sampled. Wetland and upland plant communities will be sampled to determine diversity.

2. In order to determine the effects of farm production systems (tillage, crop rotation) on wetland hydrology, a water balance will be developed for each wetland/upland tract. Precipitation and evapotranspiration will be recorded. Weirs at wetland margins will be used to determine run-off volume. Wetland circumference and depth will be used to estimate water volume. Seepage meters will be used to isolate differences in water volume due to seepage loss vs evaporation/transpiration. The water table level will be monitored using peizometers. Soil moisture and yield information will be used to determine the role of wetlands in maintaining soil moisture levels adequate for crop production in sub-humid areas.

3. In the proposed study areas, wetlands impacted by farm production systems may further impact ground water. Promising sustainable farm production systems include consideration of water quality impacts. Three types of water quality samples will be analyzed; runoff samples from weir collectors, ground water from peizometers, and surface water from the wetland. Chemical analyses will include components of the nitrogen and phosphorus cycle as well as total dissolved salts, pH, dissolved oxygen, pesticides and temperature. Soil samples from upland sites as well as run-off and wetland sediment samples will be collected for routine soil test analyses and pesticide analyses where appropriate. Denitrification by soil cores from wetland margins will be measured. Nitrogen gas loss, denitrifying enzyme activity and numbers of denitrifiers will be determined. Analyses of denitrification will allow us to calculate an estimate of gaseous N loss from the different tracts on a pounds-per-acre basis to give an idea of gaseous losses of fertilizer N under different farm production systems.

4. Production costs and net returns of major farm production systems will be estimated from farm budget generator procedures. Differences in tillage systems, cultural practices, fertilizer/pesticide use, soil type and yield will be explicitly examined in each budget. Costs and returns will be estimated per tract, per acre, and per unit of output.

5. Farm production systems per type of wetland tract will be ranked based on selected economic criteria (farmer net returns and production costs) and environmental criteria (wildlife habitat, water quality, etc.). Careful attention will be given to listing the various environmental benefits from each type of wetland tract and providing interval estimates of the magnitudes of the major environmental benefits. These environmental benefit estimates will be expressed in physical terms (wildlife numbers, water quality measures) and wetland valuation techniques will be used where possible to express these benefits in monetary terms. Production costs and net returns of each farm production system will be compared to determine the estimated opportunity costs to the farm operator of a farm production system that is compatible with the selected environmental criteria compared to the farm production system that generates the highest expected net returns.

6. In the past, information concerning the water and wildlife aspects of wetlands and their economic and environmental importance in agricultural settings has been fragmented among universities, federal agencies, and landowners. This proposed project combines experts from each area who are dedicated to a holistic approach. "Complete packages" of information will be networked through respective channels such as the extension service, classrooms, SCS, and grower groups. Outreach components aimed at elementary students will include packages for "Ag in the Classroom" and "Natural Resource" programs. Annual workshops will be organized to discuss results and acquire input for future direction. A graduate student research project will investigate learning styles and interviews will be conducted. Journal publications and bulletins will also be prepared. Innovative educational materials such as videos or interactive TV programs

may be developed for use throughout the Prairie Pothole Region of North Dakota, Minnesota, Iowa and South Dakota.

Project Duration: Two years, ending Aug. 31, 1994

Funding: $104,000
Matching: $68,000

ANC92-12: IMPACT OF TREE WINDBREAKS ON DISTRIBUTION OF INSECT PESTS AND THEIR NATURAL ENEMIES IN SUSTAINABLE AGRICULTURAL SYSTEMS

Major Participants:

University of Nebraska: Robert J. Wright (Project Coordinator), Entomology; Mary Ellen Dix, USDA Forest Service and Entomology; Mark O. Harrell, Forestry, Fisheries and Wildlife; James R. Brandle, Forestry, Fisheries and Wildlife; Laurie Hodges, Horticulture; Ron J. Johnson, Forestry, Fisheries and Wildlife;

Farmers: Jerry Newsham and Ron Raikes, Ashland, NE; Ray W. Otto, Ceresco, NE.

ABSTRACT

Historically, U.S. farmers have largely depended upon the use of synthetic pesticides to control pests of crops and trees. This has created formidable problems and broad social concerns including; a) the development of pest resistance to pesticides; b) unintentional pesticide damage to nontarget organisms such as fish, beneficial insects, wildlife and humans; and c) contamination of ground water and food by pesticide residues and metabolites. Natural enemies (parasites, diseases, vertebrate and invertebrate predators) normally do not prevent outbreaks of crop pests in traditional agricultural systems because routine application of pesticides kills or weakens the natural enemies, and common tillage practices often destroy protective nesting, feeding and overwintering sites. In a sustainable agricultural system, especially one incorporating a diversity of vegetation types, natural enemy populations could be enhanced and used to help manage crop pests without the environmental risks associated with pesticides.

Tree windbreaks provide protection for birds and predatory arthropods that consume pest insects in adjacent crop fields, thus reducing crop losses. Information concerning bird predation on pests in crops is limited, but one report of insect consumption by birds in windbreaks estimates that birds consume about 148 kg of insects per kilometer of windbreak each year. Preliminary research in Nebraska during the summer of 1991 indicated substantially greater species diversity and total number of birds in corn and soybean fields near windbreaks or other woody cover than in similar fields without woody cover. No bird damage to crops was observed. Most of the birds identified exhibited activities that are likely to be beneficial to agricultural production within the sheltered areas. No data are available on the interactions of bird populations with crop-windbreak systems during non-crop periods.

Windbreaks modify wind flow, reduce horizontal windspeeds, and alter the turbulence structure of the wind. In Great Britain aerial densities of insect species in the sheltered zones created by windbreaks were two to eight times higher than in open fields. Data collected in Nebraska in 1988-1990 indicated that predatory spiders were 2.7 times more abundant in windbreaks surrounded by crop fields than in windbreaks surrounded by native grass. Furthermore, preliminary data indicates substantially higher predatory arthropod populations within the sheltered areas than in the adjacent crops with populations declining with increased distance from the windbreak. Spider abundance within windbreaks was 180 to 480 percent higher than in the center of surrounding corn and soybean fields. Field edges immediately adjacent to the windbreaks had 50 percent more spiders than those in the center of the field.

Windbreaks oriented perpendicular to prevailing winds may act as giant sieves that filter out migrating spiders and other small predators. Wind may also directly influence a birds ability to fly or to thermoregulate, particularly when air temperatures are cold. On windy days in Nebraska, dragonflies, swallows, and other flying predators accumulate and search for prey in the sheltered zones around windbreaks

Insect pests of crops also may seek or avoid the shelter of windbreaks. By knowing which pests use windbreaks, and how to manage the windbreaks to control the pest while enhancing their natural enemies, we may be able to substantially reduce the impact of the pest on the adjacent crop. In a preliminary study in 1991, abundance of southern and western corn rootworm adults was 30 percent lower in cantaloupe plantings sheltered by windbreaks than in unsheltered windbreaks. Abundance of the striped cucumber beetle, a vector for bacterial wilt of cucurbits, increased 50 percent in the sheltered cantaloupe plots.

The concept of benefits from predator and parasite species that use windbreaks is appealing and potentially of economic significance. However, current evidence is based on data from a limited number of studies. Information is extremely limited on how tree windbreaks in combination with their associated organisms impact natural pest control and biological diversity in sustainable agricultural systems. The need for this information has been made more urgent by the recent national priority on tree planting. Tree planting is especially important in the Great Plains were trees help minimize soil erosion and protect and conserve water resources. Congress has recognized the need for trees in sustainable agriculture systems and in the 1990 Farm Bill authorized a Center for Semiarid Agroforestry at Lincoln, Nebraska. This center will advance the development, applications, and integration of conservation forestry practices in sustainable agriculture systems. Additional information is needed to more completely understand the effects of windbreaks on crops, crop pests, an natural enemies of pests so that the beneficial aspects of windbreaks can be incorporated into more effective sustainable agriculture systems. This project is a first step toward that goal.

Objectives

1. To determine the impact of tree windbreaks on the distribution and abundance of crop pests and their natural enemies.

2. To determine the impact on crop yield of pest populations influenced by tree windbreaks.

Project Duration: Two years, ending Aug. 31, 1994

Funding: $99,500
Matching: $168,653

ANC92-13: BIOLOGICAL CONTROL OF WEEDS IN CORN AND SOYBEANS WITH DWARF-BRASSICA SMOTHER PLANTS

Major Participants:

University of Minnesota: Donald L. Wyse (Project Coordinator), Weed Scientist; Nancy Jo Ehlke, Plant Breeding; Jeff Gunsolus, Weed Science; Daniel H. Putnam, Alternative Crops; Bruce Maxwell, Weed Science Ecology; William Lueschen, Branch Station Research, Agronomist.

Farmers: Larry and Caroline Olson, Granite Falls, MN; Sister Esther Nickel, Agronomy; Jackson, MN; Dave Stoltenberg, Water Quality, Madison, WI.

Overview

Corn and soybean producers make weed control decisions based on many factors such as effectiveness of control, time and labor constraints, risks associated with the failure of the treatment and cost. Based on these criteria corn and soybean producers currently employ a weed control system for corn and soybean production that is both tillage and herbicide intensive. The impact of tillage on soil erosion and the impact of herbicides on surface and ground water quality has stimulated an extensive reevaluation of weed control practices. This evaluation suggests very strongly that there are few if any viable alternative weed control practices that reduce both tillage and herbicide use currently available for rapid adoption by corn and soybean producers.

The goal of this project is to develop an alternative method of controlling weeds in soybeans and corn that is effective, economical, and more environmentally safe than currently available weed control options. This new system utilizes spring-seeded smother plants to control weeds in corn and soybeans. We have developed a new smother plant by crossing a dwarf Brassica campestris with Chinese cabbage Brassica campestris ssp. pekinensis). This new dwarf-Brassica is seeded with the crop in a band over the row, germinates under cool conditions, remains short and very leafy, has a short life cycle of 4- to 6-weeks, is highly competitive with weeds and has only limited influence on corn development. Based on this success in corn we would like to continue our research on this technology by developing additional dwarf-Brassica smother plants for both corn and soybean.

Specifically, we proposed to, 1) continue to develop, through classical plant breeding, additional dwarf-Brassica smother plants for weed control in soybeans and corn, 2) evaluate the effectiveness of dwarf-Brassica smother plants for controlling weeds and reducing soil loss, and 3) identify the factors that could impede the adaptation of the dwarf-Brassica smother plant system by farmers.

Numerous studies have shown that soybean and corn can tolerate early season competition

if the competition is eliminated within four- to six-weeks following crop emergence. The smother plant will suppress weed development for at least five weeks, enabling soybean and corn to obtain a significant competitive advantage over late emerging weeds. The smother plant will be seeded with soybean and corn, and either banded over the row or broadcast.

A plant breeding program designed to develop a range of spring-seeded smother plants is ongoing in our laboratory. In this program we are concentrating on several Brassica sp. because non-adapted Brassica sp. exhibit the general characteristics necessary for a short-term smother plant. As promising smother plant varieties are developed in the breeding program, additional field studies will be initiated to determine their effect on the control of annual weeds, and on the development and yield of soybean and corn.

The widespread use of dwarf-Brassica smother plants would have numerous environmental benefits. First, herbicide use would be tempered, reducing the potential for herbicide contamination of ground water and surface water. Second, the smother plants would help protect the soil from wind and water erosion. A reduction in water runoff would also reduce the movement of pesticides and fertilizers into streams and lakes.

The successful development of the smother plant technology to replace current weed control practices will take an equally successful education and extension program. The field-study sites will be focal points for consulting with farmers on the agronomic management techniques necessary for the successful use of short-term smother plants. Specific, well-documented, written information will accompany public demonstrations to enable farmers to critically evaluate the problems and potential of smother plants in their farming situation. It is critical that the technology transfer process emphasize on-farm demonstrations and the development of clear, site-specific information to prevent crop failures due to miscommunication. Past experience has shown that communication failures that result in crop failures can set the technology transfer process back many years. The effective flow of information between the participants is vital for the successful development of sustainable agriculture systems. Our objective is to develop and then evaluate our success of integrating all of the participants in the development of this new weed control technology.

Objectives and Rationale

1. Continue to develop through classical plant breeding dwarf-Brassica smother plants for weed control in soybeans and corn.

Water quality is one of the major issues confronting agriculture today, and the reduction or elimination of herbicides must be a major goal in all agricultural systems. By eliminating the need for herbicides the smother plant system would prevent the contamination of ground and surface water systems by, and exposure of farmers and the public to, these same herbicides. With over 95% of the nation's rural residents dependent on groundwater, the potential contamination of ground water by herbicides will remain an important topic. Development of short-term smother plants that can suppress early season weed growth will require that the chosen plant material germinate rapidly, develop faster than weed species, and suppress weed growth by competition or allelopathy and complete it's life cycle in 5- to 6-weeks.

2. Evaluate the effectiveness of dwarf-Brassica smother plants for controlling weeds and reducing soil erosion.

Successful development of a class of smother plants to eliminate the need for herbicides would reduce cash expenses by approximately $20 for corn, and $23 for soybeans. This cost reduction will be partially offset by the cost, to be determined experimentally, of the spring cover crop. Through cooperation with a broad range of farmers ranging from organic practitioners to conventional farmers, we will better determine the true potential of these short-term smother plants for farmers looking for management techniques to reduce inputs. We feel that the successful development of short-term smother plants for weed control will be effective in reducing inputs over a wide range of cropping systems. By examining the enterprise budgets of farmers involved in the proposed project, we can determine the cost effectiveness of smother plant system.

3. Identify the factors that could impede the adaptation of the dwarf-Brassica smother plant system by corn and soybean producers.

The successful development of smother plant technology to replace current weed control practices will take an equally successful education and extension program. The field-study sites will be the focal points for consulting with farmers on the agronomic management techniques necessary for the successful development of short-term smother plants. It is critical that the technology transfer process emphasize on-farm demonstrations and that clear site specific information be developed to prevent crop failures due to miscommunication. The effective flow of information between the participants is vital for the successful development of this new environmentally sound weed control technology.

Project Duration: Two years, ending Aug. 31, 1994

Funding: $67,000
Matching: $80,600

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

University of Minnesota, $67,000, ($76,600)
Sisters of Mercy, ($2,000)
Farmer, Larry Olson, ($2,000)

ANC92-14: DEVELOPMENT OF METHODS TOWARD SUSTAINABLE APPLE AND POULTRY PRODUCTION

Major Participants:

Michigan State University: Stuart H. Gage (Project Coordinator), Marian Lennington, graduate student, Crop and Soil Sciences; Laurie Rhodes, Livestock Grazing; Laura B. Delind, Anthropology Specialist;

Farmers: Quinn and Shelly Cumberworth, Dimondale, MI.

Abstract

P. Carruther (1990) claims that the main force behind the recent interest in agroforestry in the west, principally the European Economic Community, is the agricultural situation: "Over-production, the costs of supporting it and present and impending measures to control it, together with declining real farm incomes and rural employment, all point to diversification, to the need for alternative enterprises not likely to add to surpluses or involve high subsidies". In essence, agriculture needs to be more resourceful and, instead of a one-track mind-set, need a multidimensional outlook.

Is it a pasture with trees or an orchard with cattle (Zahradnik, 1983)?. Part of this project is designed to investigate the possibilities for diversification and sustainability in a typically monocultural situation: an apple orchard. Integrating poultry, livestock, and vegetables into the orchard will provide the diversification. Sustainability will be encouraged by coordinating these several enterprises within a two-year cycle. to wit: during the first year, cattle will be pastured in the orchard to graze ground vegetation, thereby controlling weed competition with the fruit trees and saving mowing and herbicide expense. Poultry will be pastured behind the cattle to save on chicken feed costs and to sanitize and incorporate the cattle manure piles. Rye will be planted in the fall after harvest to prevent leaching of soil nutrients in early spring. To prevent nitrate and parasite build-ups, no grazing will occur during the second year. Instead, nutrients from the previous year's manure will be used for vegetable production in the orchard middles. The rye will be mown to provide mulch for the vegetables. Poultry will be run through the vegetables periodically to control insects and weeds and to incorporate mulch prior to harvest. The project will determine the merits and feasibility of this two-year system, especially in terms of the contributions and manageability of animals within an orchard.

The second part of this project involves a 40-acre diversifying farm owned by the Cumberworth family in Dimondale, Michigan. Initially, the family grew hay to pay taxes on this land, and at the same time, raised some chickens, hogs, and cattle for their own use. Through word-of-mouth and the assistance of Dr. Laura DeLind, an anthropologist at Michigan State University, the family located a number of customers who were interested in obtaining low-input meat products and vegetables such as potatoes. The farm has subsequently expanded its meat operations and developed a contract marketing system with 47 customers to date. The family now wishes guidance on developing a low-input diversified farm. With the assistance of Cooperative Extension Agent Laurie Rhodes, who has had considerable experience with rotational grazing, the merits of pasturing poultry alongside beef cattle will be examined. Factors of prime interest will be the savings in chicken feed provided by pasturing; pasture condition and fertility; chicken control of cattle parasites; and management considerations.

Another critical aspect of diversified farming is marketing strategy. Dr. Laura DeLind, anthropologist at Michigan State University, has extensive background and interest in strengthening the linkage between growers and consumers. For this project she will assist the Cumberworth family in developing direct marketing relationships. This will involve programs designed to educate consumers on the social and economic implications of sustainable agriculture and to encourage producers and consumers to participate together on the process of food production and distribution at the local level. These programs will provide a preliminary set of recommendations for building social dimensions into individual farm models of sustainable agriculture.

Objectives

1. Evaluate the feasibility of integrating livestock and poultry into the orchard system.

2. Evaluation of the feasibility of integrating other horticultural crops (vegetables) into the orchard systems.

3. To evaluate the feasibility and merit of pasturing poultry simultaneously with livestock (beef cattle).

4. Develop direct marketing relationships which 1) educate consumers to the social as well as the environmental implications of sustainable agriculture at the local level, and 2) encourage the active involvement of producers and non producers in processes of food production and distribution at the local level.

Project Duration: Two years, ending Aug. 31, 1994

Funding: $46,942
Matching: $25,204

ANC93-15: WILDLIFE VALUES OF SUSTAINABLE AGRICULTURE PRACTICES IN THE NORTHERN GREAT PLAINS

Major Participants:

Northern Prairie Wildlife Research Center: Douglas H. Johnson, Project Coordinator, Chief, Northern Plains Ecology Section;

North Dakota State University: John Gardner, Director Carrington Research Extension Center;

Northern Plains Sustainable Agriculture Society: Fred Kirschenmann, farmer;

Manitoba-North Dakota Zero Tillage Farmer's Association: Lyle Samson, Executive Secretary.

Overview

This study will compare bird use and soil quality among three cropping systems (organic -- no synthetic chemicals used, no-till -- no tillage used between harvest and seeding, and conventional -- tillage and synthetic chemicals used annually). Data will be collected for three major cropland types including wheat for small grain, sunflower for row crop, and fallow for unseeded. Biologists from the Northern Prairie Wildlife Research Center (Wildlife Research Center) will determine population density and diversity of breeding, wintering, and migrating birds using the three cropping systems. All study fields will be searched to locate nests and to determine breeding effort and success. Scientists from the Carrington Research Extension Center (Research Extension Center) will characterize soil quality by measuring physical, chemical, and biological properties. The Northern Plains Sustainable Agriculture Society (Society) and the

Manitoba-North Dakota Zero Tillage Farmer's Association (Association) will collaborate in developing study plans, selecting study cooperators, and specifying data priorities. Cooperating landowners will provide study sites and information on chemical and physical inputs, crop yields, type of equipment used, and data for calculating soil erosion losses.

The data will be examined to determine the effects of residue management, timing and type of tillage, and pesticide and fertilizer use on soil quality and wildlife populations and breeding success. Practices that benefit land use or enhance wildlife populations will be communicated to individuals managing cropland on private and public lands. Recommendations will be broadcast using the Society and Association newsletters, farm journals, and scientific publications. Also, the Society will host a seminar on farmland-wildlife relationships, and the Association will include presentations at its annual workshop.

The value of croplands as habitat for many species of migrating and breeding birds is usually considered low in comparison to natural grasslands. On conventional farms, cropland is usually tilled several times after harvest and again in spring before planting. Synthetic fertilizers are used to enhance soil nutrients, and weed and insect problems are controlled with synthetic pesticides. There is growing concern that the numerous operations on conventional farms for tillage, seeding, and chemical applications eliminate most vegetative and invertebrate foods and cover creating marginal habitat for many bird species.

Organic and no-till farmers are using new and innovative approaches for raising crops. An examination of these cropping systems may reveal one or more new techniques that benefit farmers and other land managers by reducing costs or labor, by lessening soil erosion, or by increasing food and cover for wildlife. This evaluation would directly impact farmers and land managers in the prairie pothole region of the Dakotas and Canada and would generally influence farmers and land managers in the Northern Great Plains and perhaps beyond. Specific environmental change is difficult to predict but application of successful organic or no-till cropping systems could result in reduced insecticide and herbicide use, reduced tillage and associated petroleum use, reduced soil erosion, and increased plant food and cover for wildlife. Also, circumstances might require decisions on trade-offs such as reduced soil erosion and increased wildlife food and cover incorporated with increased pesticide use or decreased pesticide use linked with increased cultivation.

Objectives

1. To estimate and compare species richness and density of breeding, migrating, and wintering birds using sustainable agricultural cropping systems and conventional systems.

2. To determine if the three farming systems differ in soil characteristics that might be critical to the overall functioning of the agroecosystem, especially as it relates to wildlife populations.

3. To inform private and governmental farmland operators of management practices that both benefit land use and enhance wildlife populations.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $57,000
Matching: $36,000

The following groups received funds and provided matching funds (as indicated by the figures in parentheses):

Northern Prairie Wildlife Research Center, $24,000
North Dakota State University, Carrington Research Center, $21,000, ($24,000)
Northern Plains Sustainable Agriculture Society, $6,000; ($6,000)
Manitobe-ND Zero Tillage Farmer's Association, $6,000; ($6,000)

ANC93-16: COMPOST EXTRACTS AND THE BIOLOGICAL CONTROL OF FOLIAR PLANT DISEASE (Continuation of LNC91-31)

Major Participants:

University of Wisconsin-Madison: John H. Andrews, Project Coordinator, Plant Pathology; Robin F. Harris, Soil Science; E. V. Nordheim, Forestry and Statistics

Michael Fields Agricultural Institute: John Hall, Agronomist; Herbert Koepf

Others: Pam Porter, Agrecol Corp, Ecological Technologies; The Bruce Co., Bob Willard, Ela Orchard

Continuation

The specific objectives are: 1) to complete the testing of water extracts of various composts at a university research station and at a commercial orchard; 2) to determine the mechanism of action of the composts as direct versus indirect (antagonism of pathogen versus induced host resistance), and microbial versus cell-free microbial; 3) to determine how the volume of compost sampled in screening assays relates to predictability of scaled-up procedures necessary for field control; and 4) to investigate storage and formulation regimens for composts and compost extracts to optimize their efficacy. The approach to testing of extracts will involve standard *in vitro (Venturia* spore germination assay) and *in vivo* (depression of *Venturia* spore production; disease indices) assays, as well as orchard trials developed in ongoing work. Applying extracts to apple seedlings in growth chambers before, or concurrently with *Venturia* inoculum, or to portions of the plant not receiving inoculum, will allow any direct action of the compost vs indirect stimulation of host defenses to be separated experimentally. Sterilization of extracts or removal of microbes by filtration will enable microbial vs cell-free microbial activities to be resolved. We will determine how screening volume relates to inferences about compost efficacy by assessing extracts from subsample of 50g-1kg taken from a 20-kg composite bulk sample. The effect of storage conditions (refrigerated, frozen or dried) on efficacy of composts or extracts, and formulation as extract vs milled raw compost will be quantified in standard *Venturia* inhibition or disease suppression assays developed in the initial phase of the work.

If successful, the research will provide for conventional growers a needed alternative to

chemical fungicides and, for organic farmers, a nonchemical means to control disease. Moreover, the utility of compost extracts is by no means restricted to apple scab and, in theory, they could be used to control any foliar disease. By publicizing the concept of recycling wastes, the project will advance the sustainable philosophy among city dwellers with home gardens as well as among commercial growers. The work is consistent with ACE goals and will: 1) foster economically competitive agricultural systems, including mixed farming typical of family operations (reduced reliance on off-farm purchased inputs; conserved energy and natural resources; reduced environmental contamination and health risks); 2) provide a scientifically-based approach to non-chemical, non-polluting, biodynamic practices, specifically with respect to approaches to and explanation for composts as they affect plant pathogens; and 3) promote methods for animal waste and nutrient management that reflect recognition of agricultural profitability together with ecological and environmental values.

The work will be evaluated and conveyed to the public by: 1) ongoing meetings among the collaborators; 2) presentations to farmers at workshops and grower meetings; 3) oral and written presentations in the scientific media; and 4) annual reports to the sponsors. Additionally, outreach will be facilitated by: 5) contacts between the researchers and the Wisconsin Rural Development Council and 6) contacts obtained through the Michael Fields Agricultural Institute and the orchardist and nursery collaborators.

Objectives

1. To test water contracts of composts for seasonal and overwintering control of the apple scab disease. (Expanded original objective)

2. To determine mechanism of action as direct vs. indirect, and microbiologically-based or chemically-based. (Continuation of original objective)

3. To determine how volume of compost sampled for bioassays relates to predictability and reproducibility of assay results. (New objective)

4. To determine optimal formulation of compost or compost extract for storage and foliar application. (New objective)

Project Duration: Two years, ending Aug. 31, 1995
Funding: $91,796
Matching: $62,738

ANC93-17: AN INTEGRATED RIPARIAN MANAGEMENT SYUSTEM TO CONNTROL AGRICULTURAL POLLUTION AND ENHANCE WILDLIFE HABITAT

Major Participants:

Iowa State University: Richard C. Schultz (Project Coordinator), Forest Ecologist and Hydrologist; Joe Colletti, Forest Economist; William Simpkins, Hydrogeologist; Michael Thompson, Soil Chemist and Morphologist; Carl Mize, Biometrician and Statistician; Paul Wray, Extension Forester; William Crumpton, Wetland Ecologist; Dwayne Buxton, Forage Specialist; Louis Best, Avian Biologist

Farmer: Ronald Risdal, Roland, IA

Overview

An integrated riparian management system is proposed that can be used to rehabilitate riparian zones devoid of native tree and shrub vegetation to control the adverse effects of upland agriculture on stream water quality and to improve wildlife habitat. The proposed project builds on an already existing project dealing with quantifying the effects of a constructed multi-species riparian buffer strip (CMRBS) on stream water quality. This ACE proposal would further develop the CMRBS by developing a wetland at the outfall of a field tile line to biologically reduce the nitrogen and pesticides in the tile drainage water before it enters the stream and by establishing stream bank willow plantings to reduce stream bank erosion, a major source of stream sediment load. The result would be a unique riparian management system having three separate practices located on Mr. Ronald Risdal's farm in North Central Iowa.

The ability of this integrated riparian system to improve water quality will be quantified through the monitoring of sediment, nitrogen, and atrazine in the surface runoff, shallow and deep groundwater, stream and tile water, and plant and soil in both the CMRBS and the wetland. The rate of stream bank collapse of the willow planted stream bank will be compared to that of a non-planted one. The enhancement of fish and wildlife habitat will be assessed with a number of surveys throughout the project life and by comparison with degraded riparian areas. Costs and benefits will be developed that will allow farmers to evaluate the design, establishment, maintenance, and effectiveness of each individual practice and the integrated system. The technology transfer would consist of two field days, a self-guided trail, and four brochures describing the various practices.

The major participants in the project include the landowner farmer, a forest ecologist\hydrologist, an economist, a hydrogeologist, a biometrician, a soil chemist\morphologist, a wildlife biologist, a forage specialist, and an extension forester. This team has been working together since 1990 when the CMRBS was first established.

Objectives

1. *Demonstrate and quantify the ability of the CMRBS to filter, transform and act as a sink for the NPS pollutants.*

2. *Develop a small wetland around a field tile line outlet before the drainage water enters*

the stream.

3. *Demonstrate the ability of a combination of willow posts, stakes, and cuttings to act as a durable and environmentally acceptable system for long-term stabilization of eroding stream banks.*

4. *Evaluate the impact of the CMRBS, the field tile wetland, and the stream bank willow planting on wildlife habitat and use.*

5. *Evaluate the costs of establishing and maintaining the three riparian management systems being demonstrated on the Risdal farm.*

6. *Develop appropriate technology transfer materials and activities for farmers, policy-makers, farm groups, and others. These will include brochures, a self-guided trail, and field days.*

Project Duration: Two years, ending, Aug. 31, 1995
Funding: $90,170
Matching: $85,340

ANC93-18: ASSESSING THE POTENTIAL FOR BIOLOGICAL CONTROL OF FIELD BINDWEED *(CONVOLVULUS ARVENSIS)* WITH THE GALL MITE, *ACERIA MALHERBE*, AND THE MOTH, *TYTA LUCTUOSA*.

Major Participants:

Kansas State University: James Nechols (Project Coordinator), Entomology; Michael Horak, Agronomy; William Noble, Statistics; Dave Regehr, Extension Weed Specialist;

Farmers: Cliff Roeser, Riley County, KS

Kansas Rural Center: Jerry Jost

County Weed Directors Association: Dennis Peterson; William Scott, State Weed Specialist

Overview

Field bindweed *(Convolvulus arvensis)* is an introduced weed that is a severe competitor of wheat, soybeans, corn, and other important crops of the North Central Region, and may cause yield losses of 20-80% depending on the crop and farming system. Because of its ecological and physiological characteristic, field bindweed is difficult to control. Traditional control practices including cultivation and the use of herbicides are expensive, may pose unacceptable environmental risks, and have only a short-term effect in reducing populations. For these reasons, the development of more effective, environmentally sound, self-sustaining management strategies for field bindweed control are essential. One approach to management that meets these criteria

is the use of biological control.

Although various native arthropods are known to feed on field bindweed in the United States including the Midwest, effective natural suppression of this weed does not occur. Recently, a moth *Tyta luctuosa*, and a gall mite *Aceria malherbe* were introduced to the United States from the Mediterranean region. Limited releases of these highly host specific biological control agents have been made in Texas, Missouri, Oklahoma, Iowa, and Delaware, but data to evaluate overwintering potential, dispersal ability, or their impact on field bindweed are not available. Therefore we propose: 1) to evaluate the overwintering ability of *T. luctuosa* and *A. malherbe* in different climatic zones within the North Central Region; 2) to determine dispersal capacity of the moth *(T. luctuosa);* 3) to assess the effect of the moth (caterpillar) on field bindweed growth and determine the infestation levels necessary to ensure detrimental effect to field bindweed; 4) to investigate and quantify field bindweed population reduction by *T. luctuosa*; 5) to train and involve farmers with on-farm releases, surveying and monitoring of the biological control agent for colonization; 6) to disseminate knowledge of symptomology, ecology, and biology of the moth to farmers, extension personnel, other researchers, and weed control advisors.

A combined field, laboratory, and greenhouse will be used in the project. The overwintering and dispersal studies will be conducted on cooperator farms in replicated experimental trials. Feeding effects on field bindweed will be quantified through laboratory and greenhouse studies; and a field study will be conducted to measure the effect of different infestation levels on field bindweed populations. In addition to these trials, we will train farmers to implement on-farm releases of the organism, and to monitor for overwintering survival and colonization.

Personnel and project involvement: 1) J. Nechols and M. Horak, Kansas State University scientists, collaborators, all aspects of planning, implementation and evaluation of the project; 2) W. Noble, Kansas State University scientist, collaborator, experimental design, statistical analysis; 3) C. Roeser, farmers, on-farm releases and surveys; 4) D. Peterson, President of the County Weed Directors Association of Kansas, liaison to 100 member organization, locate study sites and cooperator; 5) J. Jost, Project Coordinator with the Kansas Rural Center, liaison to organization, locate and coordinate cooperator, disseminate results; 6) D. Regehr, Extension Weed Specialist, extension publications, training sessions; and 7) W. Scott, State Weed Specialist, liaison to the State Board of Agriculture, regulatory changes as a result of this research.

Results obtained will provide an indication of these biological control agents to colonize. They also will allow a pre-colonization impact assessment of the moth on field bindweed in the North Central Region. Successful colonization of effective weed-feeding agents may result in substantially lower herbicide use and increased crops yields thus increasing farmer profits. It also would reduce environmental risks and provide long term suppression of one of our most troublesome weeds.

Objectives

Insect biology

1. To evaluate the overwintering potential of the gall mite *A. malherbe*, and the moth *T. luctuosa* in different climatic zones within the North Central Region.

2. To determine the dispersal ability of the moth *(T. luctuosa)* at several release sites.

Plant-insect interactions

3. To determine the effects of moth (caterpillar) introductions on field bindweed growth, and determine the infestation levels necessary to ensure detrimental effects to field bindweed.

4. To investigate and quantify field bindweed population reduction by the moth (caterpillar).

Grower training and dissemination of knowledge

5. To train and involve farmers with on-farm releases, surveying, and monitoring of the biological control agent, and in the evaluation of success.

6. To disseminate knowledge of the symptomology, ecology, and biology of moth to farmers and farmer organizations, extension personnel, other researchers, and those concerned with noxious weed control.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $75,185
Matching: $32,848

ANC93-19: A BIOLOGICAL CONTROL NETWORK FOR THE SWEETCLOVER WEEVIL AND CLOVER ROOT CURCULIO

Major Participants:

University of Wisconsin: David B. Hogg (Project Coordinator) Entomology

North Dakota State University: Michael Weiss, Entomology

Michael Fields Agricultural Institute: Walter Goldstein

Northern Plains Sustainable Agriculture Society: Susanne Retka Schill, Executive Secretary

Farmers: David Podoll, Fullerton, ND; Dan Thomas, Karlsruhe, ND; Terry Jacobson, Wales, ND.

Overview

The overall goal of this project is twofold (1) to achieve a significant level of biological control of two related weevil pests, the sweetclover weevil (*Sitona cylindricollis)* and the clover root curculio *(Sitona hispidulus)* in the North Central Region, and (2) to involve farmers in learning how to work with and disseminate the natural enemies to be used as biological control agents.

These *Sitona* weevils are pests in two different cropping systems. The sweetclover weevil is a major pest of yellow sweetclover, *Melilotus officinalis*. Feeding by the adult weevil causes periodic and extensive stand reductions and even complete stand loss of sweetclover. Yellow sweetclover is a cold hardy, drought tolerant and cost effective biennial legume that is used both as a forage and source of organic nitrogen in the Northern Great Plains. Because there is no suitable substitute with similar attributes as sweetclover, loss of this crop due to the sweetclover weevil would cause serious difficulties for farmers attempting to maintain sustainable rotations.

The clover root curculio, despite its name, is primarily a pest of alfalfa, *Medicago sativa*, in the U.S. In this case it is feeding of the weevil larvae on alfalfa roots that damages the crop, and though less obvious, this damage is a significant contributor to premature alfalfa stand loss throughout the North Central Region. Alfalfa is generally recognized as the most important forage legume in the North Central Region. Although the clover root curculio does not pose the same threat to alfalfa that the sweetclover weevil poses to sweetclover, reduction of clover root curculio populations would result in a substantial improvement in alfalfa longevity and productivity.

In North Dakota, three farmers will be directly involved with NDSU entomologists in conducting the field component of the project, and in the process they will learn the basics of biological control. In Wisconsin, the field component will be conducted by UW entomologists in collaboration with Michael Fields Agricultural Institute scientists.

Objectives

1. Receive parasitoids of *Sitona* from Siberia and Moldova.

2. Raise the parasitoids in laboratory cultures and conduct studies to ascertain their behavior, host range and potential effectiveness as biological control agents.

3. Make controlled parasitoid releases in field cages at selected sites in North Dakota and Wisconsin.

4. Make open field parasitoid releases.

5. Provide selected farmers with a working knowledge of biological control in the sweetclover - *Sitona* - parasitoids system, including major farmer responsibility for the field cage releases, and encourage long term maintenance of the program through farmer networks.

Project Duration: Two years, ending Aug. 31, 1995
Funding: $35,849
Matching:

*The SARE Low-Input Sustainable Agriculture and the Agriculture in Concert with the Environment programs share funding for this project. (This project was LNC93-62)

PART IV. PRODUCER-INITIATED GRANTS FUNDED IN 1992

At its June 1992 meeting The North Central Region Administrative Council initiated a grants program designed to let producers take the lead in identifying and solving problems limiting their transition to a more sustainable agriculture. The program, Implementing Sustainable Agricultural Practices, will help the Administrative Council set the agenda for future sustainable agriculture research in the region, based on producer needs. While all LISA and many ACE projects in the North Central Region are required to have producer participation, this program was developed to more actively help identify specific issues and test and evaluate innovative solutions.

The Administrative Council received 109 applications and awarded 25 grants for producers to examine questions ranging from rotational grazing, forage and seeding methods, nutrient management and composting options to equipment modifications and tillage method comparisons. In addition, each project is required to have an outreach component such as a field day, workshop, or publication. The region allocated about $85,000 for the projects and final report and producers provided more than $250,000 in matching funds. Project reports will be compiled and published annually, increasing information dissemination among producers and helping set the agenda for future research in the region. Following is a brief description of each producer project:

Project FNC 92-1
Phil and Barbara Hueneke
RR #2, Box 126
Bellevue, IA 52031
(319) 872-4327

SARE Funding: $2,715; Matching Funds: $3,330

Cooperators:
Steve Schroeder, FFA instructor
Keith Cuvelier, soil consultant

Four parcels of land, each 2.5 acres, will be used to compare different green cover crops that can be used to replace purchased nitrogen in crop production. The four types studied are red clover, alfalfa, interseeded red clover in growing corn and no-till rye into alfalfa. Through this project, each parcel will have soil and tissue testing throughout the growing season to determine any nitrogen-nutrient deficiencies. Yields will be recorded and compared to determine which cover crops produced best.

Project FNC92-2
Ronald and Maria Rosmann
1222 Ironwood Road
Route 1, Box 177
Harlan, IA 51537-4102
(712) 627-4653

SARE Funds: $3,885; Matching Funds: $4,942

Cooperator:
Shawn Shouse, Extension soil and water engineering specialist, Atlantic, Iowa

Ten years ago the Rosmann's decided to reduce or eliminate fertilizer and herbicide use on the 320 acres they farmed first with reduced tillage and then with a ridge tillage system. This project will use a five-trial field design with ridge tillage in corn after soybeans to evaluate the economics of ridge tillage systems used with and without herbicides. The trial will be replicated six times across an entire field. The five trials are: 1) ridge-till, no herbicides, one rotary hoeing, two cultivations; 2) ridge-till, 10" banded Dual grass herbicide, one rotary hoeing, two cultivations; 3) ridge-till, 14" band of Bladex for broadleaves, one rotary hoeing, two cultivations; 4) ridge-till, 14" band of Dual and Bladex, (grass and broadleaf), one rotary hoeing, two cultivations; and 5) ridge-till control, two cultivations only. A starter fertilizer (9-18-9) at five gallons/acre will be used on all plots and nitrogen testing will be used to determine if additional nitrogen is needed with the first cultivation. Weed counts will be taken to compare weed control in all trials. Corn strips will be harvested and weighed. Cultivator experiment strips will consist of different demonstrations and experiments to obtain optimum weed control and optimum ridge characteristics, particularly on sloping ground.

Project FNC 92-3
Darrell and Donna Parks
1001 East 26th Avenue
Manhattan, KS 66502
(913) 539-1930

SARE Funding: $2,700; Matching Funds: $4,300

Cooperators:
Gwen Scott, Riley County Conservation District
Pat Murphy, Kansas State University, Extension Engineer
Mike Christian, Kansas State University, County Agriculture Agent

Adopting a more sustainable crop and livestock system in some cases depends on correctly identifying the nutrient needs of the soil and crop and the nutrients available in given sources, in this case animal manure. This project will determine 1) sensible sustainable application rates; and 2) application methods that reduce potential runoff and leaching losses while meeting actual crop needs and preventing buildup of nutrients in the soil that could contribute to pollution. The soil will be tested for available nutrients, manure will be tested for nutrients and three methods of manure application will be tested in the field: 1) present method of overground spreading with a subsequent disc operation; 2) knife application in narrow bands; and 3) sweep injection in a wider band. Leaf tissue analysis will be conducted during the growing season on various replicated rate and application method trials and crop yields will be measured and compared at the end of the trial. In addition, post-harvest soil tests will measure nitrogen and other nutrient carryover subject to leaching and runoff.

Project FNC92-4
Oren Holle
Rt. 1, Box 108
Bremen, KS 66412
(913) 337-2662

SARE Funds: $985; Matching Funds: $1,000

Cooperators:
Ed Reznicek, Sustainable Farming Project Assistant, Kansas Rural Center

Small grains such as wheat are not often included in crop rotations in northeast Kansas because farmers do not consider them as profitable as corn, sorghum or soybeans. The use of small grain and legume crops, however, are important for sustainable cropping systems. Inter-seeding sweet clover helps make wheat a more profitable crop and thus more justifiable in a rotation, but sweetclover does not work well for hay. This project examines whether annual alfalfas can provide a hay or seed cutting and still compare favorably to sweetclover for soil building purposes. The agronomic and economic benefits of three alfalfa varieties are being compared to sweet clover for forage and soil building purposes in a corn, soybean, milo, soybean, wheat-legume rotation. Sweetclover will be overseeded with three annual alfalfa varieties in side-by-side strips in wheat for possible forage or seed harvest and for plowdown the following spring for a corn crop.

Project FNC92-6
David and Rosalie Sowatzke
3156 Pierce-St. Croix Rd.
Spring Valley, WI 54767
(715) 772-4501

SARE Funding: $1,085; Matching Funds: $1,250

Cooperator:
Paul Schaefer, Network Coordinator, Western Wisconsin Sustainable Farming Network

Two seed mixtures made from forage varieties from New Zealand and Holland will be used to reseed approximately three acres of existing, rotationally grazed sheep pasture. The plot will be divided into six areas where three establishment methods will be used on the two seed mixtures (hard grazing in the spring followed immediately by no-till drilling; fall digging, plowing and seeding with cereal rye followed by spring plowing with Brillion cultipacker seeding; and fall digging, plowing and seeding with oats followed by discing and Brillion cultipacker seeding.) Plots will be tested and evaluated for ease of establishment and ability to provide high quality feed for a sheep herd. Results will be compared with existing plots. Forage samples will be taken throughout the growing season to estimate the weight/acre and available nutrients. These samples will be compared with the existing pasture areas and the test plots.

Project FNC92-7
David Michaelson
River GLO Farms
RR 2, Box 158
Dawson, MN 56232-9574
(612) 769-4683

SARE Funding: $4,974; Matching Funds: $12,253

Cooperators:
Randy Citrowske, farm employee
Land Stewardship Project
Western Minnesota Sustainable Farming Association
Michaelson Farm Partnership

Eight replications of eight different combinations of on-farm and off-farm inputs will be used to evaluate which are most economical and profitable in a sustainable system. The test will include solid seeded and 30" row soybeans in various strip tests that compare on-farm inputs with off-farm inputs for both weed control and fertility. On-farm inputs are mechanical and hand weeding for weed control and composting for fertility. This will be the fifth year of replicated strip tests comparing yield, moisture and test weight.

Project FNC92-8
Kenneth O. and Judy King
6003 E. Eales Road
Hutchinson, KS 67501
(316) 663-1470

SARE Funding: $3,950; Matching Funds: $15,620

Cooperators:
Jerry Wyse, forage consultant/seed dealer
Willy Kilmer, fencing contractor
Jerry Jost, Kansas Rural Center
Kevin Graber, banker/grazier

A few beef cattle operations in Kansas are using intensive rotational grazing, but most of these are in the Flint Hills. This on-farm grazing trial will use four to six grass and legume species adapted to this climate to provide information on which species are best. These will be planted separately and in mixtures on the open ground and interseeded into the established alfalfa, spread over several soil types on 140 acres. The trial will examine use by dairy and stocker cattle as well as stand establishment, cattle palatability and grazing potential. The farm is currently being converted from a cash crop/dairy operation to a grass-based seasonal dairy and stocker program.

Project FNC 92-9
William and Elizabeth Kleinschmit
RR #3, Box 185
Hartington, NE 68739
(402) 357-2217

SARE Funding: $5,000; Matching Funds: $6,800

Cooperators:
Dennis Schulte, University of Nebraska Agricultural Engineer
Michael Lechner, University of Nebraska, County Extension Agent

A used windrower will be converted to a composting machine to turn manure into a compost product for field use. The use of a compost machine, while beneficial to a sustainable system, often may be cost prohibitive for the smaller producer. Fabricating a windrower for this use allows greater flexibility for the producer. The compost will be analyzed and applied in the field, allowing fertilization of more acres with existing manure and fewer purchased inputs. Yields will be recorded and compared with similar fields where compost was not applied.

Project FNC 92-10
Susan Pollak and William Andres
W4146 200th Avenue
Maiden Rock, WI 54750
(715) 594-3975

SARE Funding: $2,311; Matching Funds: $4,660

Cooperator:
Paul Schaefer, Network Coordinator
Western Wisconsin Sustainable Farming Network

The farm is now in its second year of establishing a rotational grazing system for a herd of 30 Jersey cows. Forage, soils, optimal fertility and correct forage mixes will be evaluated and improved to achieve more balanced rations. To achieve the project goals: 1) A soils/crop consultant will take and interpret soils and forage tests in each of the 35 paddocks and the consultant's recommendations will be followed concerning fertilization, seeding, and weed control; 2) a permanent perimeter fence of aluminum electric wire will be erected; and 3) a dairy nutritionist will be consulted for help in balancing cattle rations for both milking and dry cattle in accordance with the pasture-based system.

Project FNC 92-11
Lowell Schroeder
Rt. 1, Box 55
Stanton, NE 68779
(402) 439-5398

SARE Funding: $1,500; Matching Funds: $650

Cooperators:
Gerald Henzler, Producer
Gary Young, Producer
Sam Welsch, Nebraska Sustainable Agriculture Society

Non-chemical fly control traps will be developed, constructed and tested for cattle in both cow-calf and dairy herd situations. Reduced fly populations should lead to reduced production losses due to blood loss, pinkeye, and cows bunching to fight flies as well as fewer purchased inputs of fly traps, sprays, or feed additives. The fly trap would be constructed according to approved plans and placed in the pasture near the watering point. The Lowell Schroeder farm would use the fly trap on a cow-calf herd and the Gerald Henzler farm would use it in a dairy herd with a rotational grazing system.

Project FNC 92-12
Robyn Rohlfing
RR 1, Box 108
Plymouth, NE 68424
(402) 656-3387

SARE Funding: $5,000; Matching Funds: $15,964

Cooperator:
Paul Hay, University of Nebraska, Extension agent

Biological weed control can be used to eliminate the cost, use and risks of chemical herbicides while providing an established, marketable, perennial crop. Mulched, desirable, aggressive plants are set among undesirable weeds, eventually choking out the weeds. This farm has used a biological weed control system for six years in an organic garden setting. This project will provide for nine biological weed control agents to be studied in four equally sized plots: 1) control plot -- weeds but no biological weed control agent; 2) weeds and a biological weed control agent in a low physical labor setting (farm style); 3) weeds and a biological weed control agent, mulched at planting; and 4) weeds and a biological control agent in a high physical labor setting (garden style), mulched and weeded as necessary. The nine biological weed controls to be studied are: lemon balm, comfrey, orangemint, peppermint, pennyroyal, yarrow, chives, lamb's ear and ribbon grass. They were established because of their aggressiveness, low-care maintenance, low initial cost of establishment, and marketability. This study also will include the research, survey and recording of 42 weeds that might eventually be used for biological weed control.

Project FNC92-13
Alan Brutlag
RR 1, Box 41
Wendell, MN 56590
(218) 458-2114

SARE Funds: $5,000; Matching funds: $17,653

Major participants:

Jerry Smith, crop consultant
Bob Aune, machinery manager
Joseph Giles, Soil Scientist, North Dakota State University
Allan Cattanach, Extension Sugarbeet Specialist, North Dakota State University and University of Minnesota
Allen Dexter, Extension Sugarbeet Specialist, North Dakota State University and University of Minnesota
John Bergman, sugarbeet seed sales
Don Lilleboe, editor "The Sugarbeet Grower"
Victor Klosterman, chief engineer, Alloway Rau Manufacturing

Traditionally ridge-tillage has not been used much in sugarbeet production because of problems with crop rotation, soil type, residue management and row width. This project will modify a ridge-tillage system and adapt it to sugarbeet production so producers can benefit from the agronomic and environmental advantages of ridge-tillage. Soon after small grain harvest, a ripper will be used 12" to 14" deep to break up compaction and control residue. In the fall, a cultivator will be used to build ridges. De-ridging and planting into a moist, well-drained, warm seed environment should net higher yields and profits because of an increased stand, emergence and seedling vigor when dry springs occur. By planting a spring cover crop at the same time, the fragile sugarbeet seedlings can be protected from moving soil and the strong spring winds of the northern Great Plains. (Farmers have been known to replant beets as often as three times in one spring using conventional methods.) Tests will include replicated plots with reduced nitrogen use to improve quality and profits and demonstrate methods of sustainable weed control.

Project FNC 92-14
James H. Rose
RR 1, Box 226C
Bringhurst, IN 46913
(317) 268-2669

SARE Funding: $3,620; Matching Funds: $4,600

Cooperators
Don Rhine, Purdue University, Agricultural Engineer

A recent USDA study showed a major increase in tomato production when planted into a mat of spring mowed hairy vetch, but a seeder which can plant into the heavy residue is not readily available to a smaller farm. (This farm is producing 30 or more organic vegetables on six acres for local sales.) Through this project a two-row, multiple vegetable seeder will be leased and modified to plant in heavy crop residue, reducing the need for chemicals for weed control. Side-by-side plantings of three major vegetables (tomato, sweet corn, green beans) will be made, half as has been done previously and half in the matted vetch mulch. Records will be kept and compared for vegetable earliness, quality and total yield for each vegetable. In addition, other vegetables will be planted both conventionally and in mulch to assure feasibility with various seed sizes, although extensive records will not be maintained for the project from the latter trials.

Project FNC92-15
Turkey Ridge Orchard
RR 2, Box 264CC
Gays Mills, WI 54631
(608) 735-4562

SARE Funding: $4,700; Matching Funds: $5,750

Cooperators:
John Aue, a trained entomologist
George Siemon, an independent dairy farmer who raises about 7,000 chickens

A sustainable management method will be tried to control plum curculio in an apple orchard to a level of 5 percent or less fruit damage without the use of chemicals. Currently, no organic sprays, natural predators or pheromone disrupting devices have been found to sufficiently control this pest. Ground feeding chickens will be tested as a sustainable control measure for the plum curculio. Chickens are audibly attracted to the plum curculio during the insect's early season mating period. The orchard will be scouted for the pest and chickens will be moved to the appropriate areas. A secondary benefit may be the growing market for range-fed chickens. This project will consider the variety of chicken most suited for ground feeding; the age of the chicken when introduced to the brooding houses and orchard; the training period necessary for the chickens; and the slaughter date. In addition, a method for estimating current and future infestations will be tested.

Project FNC92-16
Lawson Jones
Route 2, Box 90
Webster, ND 58382
(701) 395-4437

SARE Funding: $4,400; Matching Funds: $8,700

Cooperator:
Lee Jones, partner in the farming operation

Previously wheat has been successfully seeded into untilled sunflower residue by interjecting one crop season of chemical fallow, reducing chemical use and tillage passes and achieving greater erosion control. Seeding sunflowers into wheat residue has not been as successful, chiefly because of the cooler soil temperatures. This producer suggests that a tilled row band will solve this problem, making the sustainable system more successful. A tool bar/cultivator must be adapted to make it possible to till a row-band in the residue, creating a seedbed for spring-planted sunflowers. The row bad will be a tilled area approximately 12-15 inches wide centered on a 30" row spacing. The crop residue left between the rows will trap winter precipitation and reduce evaporation in spring and early summer, promoting seedling growth.

Project FNC92-17
Lee Quaintance
Rt. 1, Box 159
Edgerton, KS 66021
(913) 882-6797
SARE Funds: $2,315; Matching Funds: $11,572

Cooperators:

Rick Miller, Kansas State University, Johnson County Extension Agent
Willy Kilmer, fencing consultant
Randy Laue, private feed consultant

Currently on this Kansas farm, cattle are being fed on crop residue in the fall and in a drylot over winter, necessitating the movement of manure. However the potential exists for manure to run off into local streams, contributing to pollution concerns which the EPA is now monitoring. Through this project rye sown in the fall for fall and spring grazing of stocker cattle with rotational strip grazing in spring will be studied. Rye would fit well as a spring green manure crop to be rotated into a row crop since it acts as a nitrogen trap crop and provides some allelopathic effects. Evaluation will address the following questions: 1) What rye variety provides the best palatability and forage production? 2) How does winter wheat compare with rye for fall grazing? 3) What is the best low-cost means of rye establishment -- no-till versus broadcast? and 4) Does rotational strip grazing provide a more profitable grazing management system? An additional field will test four varieties of rye for grain production.

Project FNC92-18
Ed Jeanquart
249 Cty XC
Forestville, WI 54213
(414) 856-6889

SARE Funding: $5,000; Matching Funds: $2,650

Major Participant:

Kevin Kiehnau
Project co-leader
6265 Kiehnau Road
Egg Harbor, WI 54209
(414) 743-5255

Cooperators:

Northeast Wisconsin Sustainable Farmers Network
Door County Environmental Council
George Stevenson, Assistant Director of the University of Wisconsin-Madison Center For Integrated Agricultural Systems
John Bobbe, coordinator, Northeast Wisconsin Sustainable Farmers Network

Case studies of two dairy farms will be conducted to evaluate labor and time management needed for sustainable farming systems and to plan for and test possible modifications. Adoption of sustainable farming practices involves changes and substitutions of inputs, many of which may involve increased management and labor, possibly limiting the time and quality of life available for the farm family, in particular in these case studies, the dairy farm family. These case studies will allow the project leaders to more closely examine the labor and quality of life issues within each of these two sustainable systems and where appropriate, make comparisons between the two. Each farmer will maintain a daily log of activities and time spent on them during the peak labor/management months of May, June, July, August, and September when most of the planting, harvesting and other activities associated with livestock management occur. These entries will then be categorized and analyzed. Information collected on these two farms will be compared with similar data being collected by the University of Wisconsin Madison Center for Integrated Agricultural Systems on farm families making the transition to rotational grazing. Modifications which may be considered, depending on the evaluation of time spent with certain activities, include: custom hiring of some field operations or the inclusion of other sustainable practices to lessen the time spent.

Project FNC92-19
Kevin and Lisa Kirker
15280 North 60th Ave.
Merrill, WI 54452-9109
(715) 536-2293

SARE Funding: $2,300; Matching Funding: $7,740

Cooperators:
Tom Cadqallader, University of Wisconsin, Extension Agent
Arlan Anderson, Technical College Dairy Instructor

Producers will plan, conduct and evaluate the transition from raising dairy replacement heifers in a confinement system with all feed purchased to a system that incorporates rotational grazing using portable fencing, feed, and water systems. The growth rate of the heifers will be monitored, forage samples will be taken and excess forage will be harvested. Heifers will receive synchronized artificial insemination while on pasture. Primary barriers to adopting sustainable agriculture which will be addressed by this project are: 1) achieving a balanced ration using farm grown feeds that are cost effective; 2) getting heifers on pasture bred for a 24-month calving interval without using a bull; 3) keeping labor to a one-man operation; 4) technical knowledge and experience raising replacement heifers; and 5) financial constraints of researching a new sustainable agriculture program and fully converting to a proven cost effective program.

Project FNC 92-20
Charles McNeal
2154 W. 240th Drive
Paradise, KS 67658
(913) 885-4436

SARE Funding: $2,788; Matching Funds: $8,150

Cooperator:
Dick Golloday, Kansas State University, Osborn County Extension Agent

An intensive grazing system in a field of Soil Bank grass will be developed and evaluated with a combination double stocked-cell grazing system followed by grazing of a legume inter-seeded in wheat. Fencing will be installed and a water system provided. Rate of gain, total gain, cost per pound of gain, grass condition, legume stand establishment, interference with wheat harvest and performance data of the cattle will also be recorded and evaluated.

Project FNC 92-21
Tim Kunard
Rt. 1 Box 143A
Edgerton, KS 66021
(913) 883-4788

SARE Funding: $2,200; Matching Funds: $4,500

Cooperators:
Dick Golloday, Kansas State University, Osborne County Extension Agent
Arlen Frank, local bank president
Tom Boehm, Johnson County Farm Bureau President
Willy Kilmer, fencing and grazing consultant

A management system will be developed and two legume establishment methods, broadcast and no-till drill, will be tested for a 180-acre newly established rotational grazing system. In addition, the amount of time needed to manage the rotational grazing system will be evaluated and compared with the past conventional approach. These comparisons will be used in a quality of life evaluation to see if rotational grazing and the tallow bale treatments provide more time for the family. A heated sprayer with a pump to apply melted beef tallow to large round bales will be developed and tested to see if it offers a viable option to other storage facilities for weather protection. This should be more cost effective than barn storage or allowing the hay to become weather damaged.

Project FNC92-22
Michael and Debi Herren
RR #1, Box 77
Kampsville, IL 62053
(618) 653-4254

SARE Funding: $2,951; Matching Funds: $14,902

Cooperators:
Bill McCartney, Two Rivers RC&D Administrator
Rick Zipprich, University of Illinois, Extension Agent

Gary Potts, Illinois Department of Conservation, Wildlife Biologist
Ralph Zipprich, Vice-president, Bank of Kampsville

The project will aid in the establishment and evaluation of rotational grazing pastures on highly erodible land to benefit cattle and buffalo production. A permanent pasture will be established with a warm season Eastern gamma grass and a cool season Matua brome grass, both perennial prairie grasses. Hi-Tensile fences will be installed so areas can be better used for rotational grazing, haying, and seed production. Eventually the project leaders hope to establish a rotational grazing system using 60% cool season grass and 40% warm season grass, thus improving the habitat for wildlife, providing quality forage with excellent yield potential, and decreasing the potential for soil erosion. Establishment of fields will provide a seed source and help further pasture improvement while reducing startup costs.

Project FNC 92-23
Pete Ferrell
P.O. Box 59
Beaumont, KS 67012
(316) 843-2721

SARE Funding: $5,000; Matching Funds: $56,744

Cooperators:
Jerry Russell, Karen Russell, and John Rasinski, co-managers of the ranch
Dale Kirkham, SCS

A significant amount of time and capital are required to convert large tracts of traditional grazing areas, such as found in the Flint Hills, to the more desirable and sustainable practice of time-controlled grazing. This project would attempt to simulate the activity and response observed in existing grazing cells using none of the technology (fence and piped water), but rather through the use of a professional herder. The herder and dogs would confine the multi-species herd to no more than 75 to 100 acres at any one time, allowing the herd to evenly and heavily graze an area while allowing appropriate rest for the remaining acreage. The herder would be used for about five months, from May to September. The project's goal is to achieve as good or better production (measured in both pounds and dollars per acre) on "open", non-crossfenced land as is currently achieved with grazing cells, which are significantly more productive than conventional stocking methods. If proven viable, herding could, in the long run, provide more jobs in economically distressed rural areas. An investment in people and good husbandry may prove superior to additional hardware.

Project FNC 92-24
Kathy Thiel
16104 S. Fondney Rd.
Chesaning, MI 48616
(517) 845-2696

SARE Funding: $2,020; Matching Funds: $17,050

Cooperators:

Joe Scrmiger, organic fertilizer dealer/farmer
Barb Krupp, seed dealer/farmer
Steve Poindexter, Michigan State University, Extension Agent

Development of a program to raise organically certified beef requires on-farm feed testing and mixing. Changing harvest practices to use a combine with a recleaner will eliminate the spread of weed seed and construction of a better corn crib and a grinder will allow on-farm feed development according to organic certification standards. This project will help provide for a livestock consultant and crop consultant to provide guidance and support with the transition to a more sustainable system with OCIA-approved supplements.

Project FNC 92-25
Kenneth Wallingford
Rt. 2, Box 199
Effingham, KS 66023
(913) 886-6706

SARE Funding: $3,400; Matching Funds: $4,100

Cooperator:

Ed Reznicek, Sustainable Farming Project Assistant, Kansas Rural Center

Crop rotation and transition plans that are equally or more profitable than the current corn-sorghum-soybean cropping system, but with fewer purchased fertilizer and chemical inputs, will be developed and evaluated. In addition set-aside and small grain acres will be seeded to clovers.

Project FNC92-26
Christopher Werronen
The Lake-Geauga CSA Project
8345 Brakeman Road
Leroy Township, OH 44077
(216) 254-4528

SARE Funding: $2,430; Matching Funds: $12,550

Cooperators:

Chris Werronen, bio-dynamic OEFFA-Certified farmer
Lake County Soil and Water Conservation Board
Ben Stinner, Ohio State University Sustainable Agriculture
Department of Entomology
Mick and Linda Naaco, OEFFA-certified farmers
Ted and Molly Bartlett, OEFFA certified farmers
Mark Walker, Producer

Using several farms with greatly varying soil types, drainage options, etc., a rotary spader

tillage tool will be tested for short-term and long-term effects on ecology and compared to the moldboard plow and rototillage. Side-by-side plots with root, forage and grain crops will be used. The spader is expected to improve soil drainage and root penetration without compaction.

SUBJECT INDEX